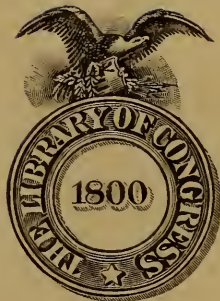


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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 224

SOME DESERT WATERING PLACES
IN
SOUTHEASTERN CALIFORNIA AND
SOUTHWESTERN NEVADA

BY
WALTER C. MENDENHALL



WASHINGTON
GOVERNMENT PRINTING OFFICE
1909



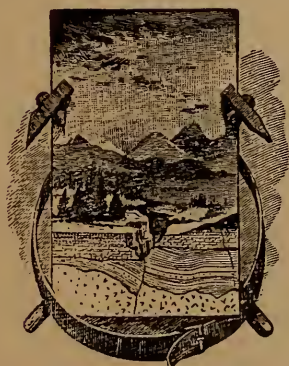
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22, 7/22/21

CONTENTS.

	Page.
Introduction.....	5
Area considered.....	5
Mineral resources and industrial developments.....	6
Sources of data.....	7
Physical features.....	8
General character of the region.....	8
Death Valley basin.....	9
Soda Lake.....	10
Salton Sink.....	10
A great trough.....	10
Fault lines.....	11
Climate.....	11
Water supply.....	13
Origin.....	13
Rivers.....	13
Springs.....	15
Finding water.....	16
Camping places.....	16
Mountain springs and tanks.....	17
Dry lakes.....	17
Geologic hints.....	18
Vegetation as a guide.....	20
Hints on desert traveling.....	21
Teams, hay, and grain.....	21
Tools.....	22
Clothing, bedding, etc.....	22
Provisions.....	23
Water.....	23
Fuel.....	24
Getting lost.....	24
Main routes of travel.....	25
Starting points.....	25
Frémont's trail.....	25
Old Spanish trail.....	26
Mohave-Keeler route.....	26
Death Valley routes.....	26
Bullfrog routes.....	27
Searchlight route.....	28
Needles-Parker route.....	28
Amboy-Dale route.....	28
Mecca-Dale route.....	28
Victorville routes.....	28
Banning-Dale route.....	29

	Page.
Irrigating and artesian waters.....	29
Irrigated areas.....	29
Artesian waters.....	29
Description of springs.....	30
Symbols used.....	30
California.....	31
Nevada.....	87
Index.....	95

ILLUSTRATIONS.

	Page.
PLATE I. Map of southeastern California and southwestern Nevada, showing location of watering places.....	In pocket.
II. A, Death Valley, looking north toward the Black Mountains; B, Out West Well.....	10
III. A, Kane's Wells; B, Coyote Well.....	60
IV. A, Providence Wells; B, Box S ranch.....	66

SOME DESERT WATERING PLACES IN SOUTHEASTERN CALIFORNIA AND SOUTHWESTERN NEVADA.

By WALTER C. MENDENHALL.

INTRODUCTION.

AREA CONSIDERED.

This report relates especially to the southwestern part of the Great Basin—the portion of it that is bounded on the west by the Sierra Nevada and Sierra Madre, on the east by Colorado River, on the south by Mexico, and on the north by the parallel between Tps. 4 and 5 S. of the Mount Diablo base line. It includes the arid portions of southeastern California and those adjacent parts of Nevada that are most easily reached from California points. This region is known generally to the dwellers in the less arid districts west of the Sierra as “the desert,” but local names are applied to its various subdivisions. Among the more important of the subdivisions are the Colorado and Mohave deserts and the Death Valley region.

The Colorado Desert is that definitely limited arid valley which extends from San Geronimo Pass southward to the Gulf of California, and includes the depression known as the “Salton Sink.” The Mohave Desert lies farther north and its boundaries are not so definite, but it includes much the greater part of San Bernardino County and the eastern portions of Los Angeles and Kern counties, Cal. The Death Valley region, which lies north of the Mohave Desert, stretches eastward from the Sierra Nevada, covering a large part of Inyo County, Cal., and extending into Nevada. It is named from its central feature, Death Valley, the lowest point on the continent.

The desert region outlined above and shown on the accompanying map (Pl. I) covers an area of about 68,000 square miles. The wells and springs within it are few in number and are very irregularly distributed. In some districts watering places occur in groups; in other tracts they are 30 to 50 miles apart. So irregular is their distribution that it is important that they should be located as definitely as possible and described for the benefit of prospectors and other travelers. The scarcity of water and the importance of a knowledge

of its whereabouts are indicated by its cost in many of the mining camps and by the frequency with which the press records instances of death from thirst in the more remote parts of the desert.

MINERAL RESOURCES AND INDUSTRIAL DEVELOPMENTS.

The mineral resources of the region under discussion are being developed with a rapidity that is attracting general attention. The most important of these resources is gold, and the present intense interest in the desert is in large part due to the discovery and development within it of mines that are heavy producers of this metal.

The resources of the region, however, are not confined to the precious metals, but comprise a wide range of mineral products of economic value. Among these may be mentioned several valuable salts, including borax, soda, gypsum, and common salt; building material, including marble, onyx, brick clays, and cements; baser metals, like copper, iron, and lead; and gems, among which are turquoise and opal. Just west of the desert proper, in the mountains of San Diego and Riverside counties, precious tourmaline, kunzite, and the rarer garnets have been discovered in connection with the pegmatite dikes there. These products are widely distributed throughout the desert counties. The existence of some of them in commercial quantities and available form is as yet problematic, although their occurrence is known, while important industries are already based on others.

The building of railroads in the desert within the last three years and the projection of other lines not yet built indicate for the future a marked increase in the mineral output of this region. The Atchison, Topeka and Santa Fe Railway, generally known in the West as the Santa Fe, has one branch extending from Goffs, on its main line, northward to Ivanpah, a distance of about 50 miles; another from Ludlow southward 7 miles to Stedman; and a third running northward from Kramer to the mining camps at Randsburg and Johannesburg, a distance of 25 miles. A road has also been built from Ludlow to Bullfrog, Nev., with a branch to the Lila C. borax mines.

The Santa Fe is also constructing a road from Wickenburg, Ariz., to Parker, on Colorado River, and thence to Bengal, Cal., on the main line. This particular work is intended to correct the alignment of the transcontinental line, and to reduce grades and shorten the distance between Los Angeles and Chicago.

The San Pedro, Los Angeles and Salt Lake Railroad has completed a road from Las Vegas, Nev., to Bullfrog and Goldfield, Nev. Its main line is in operation from Daggett northeastward across the intervening deserts to Ogden, Utah, and is giving active stimulus to gold, silver, and lead mining. The Southern Pacific has a branch on the Colorado Desert, running from Imperial Junction southward

to the Imperial Irrigation Colony lands, and across the boundary into Mexico.

A line is being built that will unite the Southern Pacific branch at Keeler, on the east side of Owens Lake, with Mohave, near the southern edge of the Mohave Desert. Other lines are also projected which, if constructed, will connect Bullfrog directly with Los Angeles.

This unusual activity in railroad work, due in part to recent mining developments, has so stimulated prospecting that there is a large influx of strangers, many of whom do not fully realize the danger of traveling through an arid region in which springs are few and far between. The dissemination of information concerning the locations of known watering places and the possibilities for locating and developing water at other favorable points is therefore an urgent need. To meet this need the following report has been written and the map that accompanies it has been prepared.

SOURCES OF DATA.

The larger part of these data was compiled by Gilbert E. Bailey, who for several years has been obliged to traverse repeatedly many of the main desert roads and trails. At the outset of each trip it has been necessary to select, so far as possible, lines of travel along which water could be found, and to decide on springs that would be suitable sites for camps from which to penetrate the surrounding region.

It was not originally expected that the data thus slowly accumulated for personal use would be assembled for publication. The records are therefore by no means complete, nor are they of uniform value, for Mr. Bailey's acquaintance with some districts in the desert is more intimate than with others. Knowledge of watering places in this region is vital, and it is hoped that even the incomplete information assembled in the following pages will be useful.

In making the generalized base map (Pl. I) on which the location of the wells and springs is shown, data differing greatly in value and accuracy have of necessity been used. For the region from Death Valley northward and for the southwestern part of the area, including the Colorado Desert, the later topographic sheets of the United States Geological Survey are available and furnish satisfactory data. For the area along Colorado River from Needles northward old reconnaissance maps issued by the Survey were utilized. Of the region from the Colorado Desert and the Sierra Madre northward to Death Valley no satisfactory surveys have been made, and dependence has necessarily been placed on Land Office maps, railway surveys, and the various general, more or less inaccurate maps that have appeared from time to time. Probably the best of these—certainly

the one which is most highly regarded by prospectors and desert travelers generally—is the Fred T. Perris map of Riverside and San Bernardino counties. With such corrections as it has been found possible to make upon it, this map has been largely followed. In the desert portions of Riverside County especially, for which almost no late data exist, the Perris map is still the best guide. Developments, especially railroad surveys and construction, have given the information necessary for some changes in the northern portion of the area covered by it.

A number of the principal roads through the desert are indicated on the map. They are not surveyed, so that only approximate locations are possible, but these at least indicate the usual routes of travel.

The descriptions of the springs and watering places have been taken largely from the notes of Mr. Bailey. A large proportion of them have been visited at various times, but descriptions of others have been supplied by other desert travelers. R. H. Chapman, topographer, United States Geological Survey, has supplied notes on a number of wells and springs in the Amargosa district, with which he is familiar; C. A. Pinkham has aided with information concerning the Colorado Desert region; C. S. Alverson, of San Diego, has also contributed notes on this area; and many miners and prospectors have supplied information with which it is not possible to credit them individually.

On the whole, it is believed that fairly adequate and accurate descriptions are given of most of the better known and more accessible springs and wells, and that many of those which are less well known are included. Of course, numbers of springs exist in the higher mountain ranges of the desert that are known only to prospectors who are familiar with the details of these ranges. These watering places, however, are inaccessible to the casual traveler. The valley wells and springs, or at least those accessible from the most used highways, are the ones on which he must depend. It is hoped that the greater number of these are described in the succeeding pages. The data will be found more complete for the northern than the southern part of the region mapped (Pl. I).

PHYSICAL FEATURES.

GENERAL CHARACTER OF THE REGION.

The arid region lying between Colorado River and the Sierra of California shows a marked contrast in nearly all its physical conditions and scenic features with the region lying west of the great range.

To the geographer the most striking characteristic of the country east of the base of the Sierra Nevada is the fact that it is a region of

interior drainage. For this reason it is known as the "Great Basin." No streams that rise within it carry contributions to the ocean, but all the snow and rain that falls inside the rim of the basin is returned to the atmosphere by evaporation, either directly from the soil or after it has found its way into some of the lakes or sinks that occupy depressions in the irregular surface.

Some of the valleys or plains that separate the mountain ranges are absolute deserts, totally destitute of water, and treeless for a space representing many days' journey, the gray sagebrush alone giving life to the landscape. Each of the main desert basins includes a large area in which the land slopes toward a central depression, and each has a main drainage way through which flows an intermittent stream whose bed is dry most of the time along the greater portion of its course.

Many of the valleys have in their lowest depressions playas, or mud plains, left by the evaporation of intermittent lakes, and some of these are of great extent. Portions of some of the valleys have become incrustated to a depth of several inches with alkaline salts, which cover the surface as an efflorescence and present the appearance of drifting snow. Most of the permanent lakes into which some of the surface drainage finds its way are saline and alkaline. Their shores are desert wastes, shunned by animals and by all forms of life except salt-loving plants. The floor of the desert is dotted with many other smaller sinks or depressions that have no outlet and no inflow except during the rare desert storms. These are known locally as "dry lakes," "borax lakes," "salt lakes," "alkali marshes," etc.

DEATH VALLEY BASIN.

Death Valley Basin (Pl. II, *A*) is the sink of the Amargosa (Spanish for "bitter"), a name that was given to the river by Gen. J. C. Frémont in 1844. This stream, which is dry for the greater part of the time throughout much of its course, rises in a group of springs that lie about 17 miles northeast of the town of Bullfrog, Nev., in Oasis Valley. Its course is a little east of south until it passes Franklin Dry Lake; thence it flows southward through a deep canyon into South Death Valley. There it turns to the west and north, and is finally lost near Saratoga Springs. The Amargosa is about 140 miles long. It repeatedly disappears and reappears, flowing a short distance and then sinking, its water being absorbed by the sands until its channel crosses a ledge of bed rock, when it again emerges to view. Its water, which is potable near its source, percolates slowly downstream through the sands and takes up increasing quantities of alkaline salts from the soil, so that when it comes to the surface along its lower course, the water is charged with these salts, and though to

the eye it may appear potable, is unsafe to drink. This condition prevails only along the middle and lower courses of the stream. It is worse during flood periods, when quantities of surface alkali from along the banks of the stream are taken into solution. Near its source, where the water first rises in the springs, it is of excellent quality.

In going toward any point of the compass from Death Valley it is found that the floor of the basin gradually rises. In traveling southward one passes over low divides and gradually descends to Soda Lake, the sink of Mohave River. From Soda Lake the ground rises toward the east to the New York Mountains. Beyond these the drainage is toward Colorado River. West of Death Valley, the floor of the desert, above which several high ranges stand, gradually rises to the foot of the Sierra Nevada.

SODA LAKE.

Soda Lake is the sink of Mohave River, which rises in the San Bernardino Mountains and flows to Barstow, and thence northeastward to this sink. The river is over 100 miles long, but except during the flood season there is little surface flow save where ledges of rock athwart its course force the water to the surface.

SALTON SINK.

The Salton Sink, the lowest point of the Colorado Desert, was a part of the Gulf of California in comparatively recent geologic time, but it has been separated from the present gulf by the growth of the delta of Colorado River. Normally it receives only the occasional overflow from distributaries of this river, but in 1904 the Colorado was largely diverted to it, and only recently (1907) has that river been confined to its proper channel. The sink, therefore, is now partially filled by a lake with an area of nearly 500 square miles, which will probably not dry away completely for fifteen or twenty years.

A GREAT TROUGH.

The most important sinks of the desert form a more or less continuous group along a northwest-southeast line, which may be spoken of as the Great Trough.

The Death Valley axis is about 150 miles long, and extends from the north end of the valley southeastward to Silurian Dry Lake. There begins the sink of the Mohave Basin, which extends southward through Soda Lake and the Devil's Playground to Bristol, Cadiz, and Danby dry lakes, a distance of over 125 miles. It is separated from the Death Valley trough only by the low divide between Silurian Lake and Silver Lake, which are less than 15 miles apart.



A. DEATH VALLEY, LOOKING NORTH TOWARD THE BLACK MOUNTAINS.



B. OUT WEST WELL.

The trough of the Colorado Desert extends from San Gorgonio Pass southeastward through the Salton Sink to the Gulf of California. It is separated from the Mohave Basin by the San Bernardino, Cottonwood, Chuckwalla, and Chocolate mountains, and so forms an overlapping parallel axis of depression. This great axis is known to be closely related to widely extended geologic structures, and it is probable that the Death Valley axis has been similarly determined.

In addition to these major controlling depressions, the entire desert area consists of a series of more or less nearly parallel ranges and intervening minor desert valleys. In the northern part of the area the trend of these features is nearly north and south, and in the southern part the trend swings to the southeast; but in the intermediate region there is an area of confused, broken ranges in which definite trends seem to be lacking.

FAULT LINES.

It is well known that the eastern front of the Sierra Nevada is a great fault scarp, but it is perhaps less generally known that the north face of the San Gabriel Mountains is a similar structural line, which extends southeastward through Cajon and San Gorgonio passes and into the Colorado Desert. It is regarded as probable, too, that the great trough which has been described as extending northwest and southeast through the desert, along the line of the greater sinks, owes its origin to crustal movement. The basin-range type of structure, the tilted block first recognized by Gilbert, involves faulting along the uplifted edge, and recent geologic work in the desert has proven the existence of much faulting of the block type in the Bullfrog district.^a It is not unlikely that when structural details shall have been worked out many of the strongest of the desert springs will be found along these fault lines, and that their waters will prove to be of deep origin and independent of local rainfall and local drainage. It is difficult otherwise to account for many of the springs.

CLIMATE.

The physical feature that exercises the greatest control over the climate of the Southwest is the great Sierra, which gives rain to the lands that lie west of it and withholds it from the desert to the east. The winds, which are moist and cool along the coast, shed their moisture upon the high mountains, and are dry when they reach the interior, where they absorb moisture from both the soil and the vegetation.

^a Bull. U. S. Geol. Survey No. 303, 1907, pp. 50-52.

The climatic characteristics of the desert are its excessive summer heat and its dryness. The temperature rises occasionally to 125° F. in the shade, rarely falls below 70° at any time during the five hot months, and will average over 90° during this period. Exceptionally in the lowest points, as at Salton and in Death Valley, the shade temperature reaches 129° or 130°. During these periods of excessive heat men exposed to the sun's rays without water quickly perish.

The air is usually not stagnant, but is in active motion. Gales of a few hours' duration are common, and some of them bring sand storms. Rain may fall frequently in the mountains and occasionally in the valleys, and clouds are by no means rare, yet the heat and the wind together keep the surface very dry and the relative humidity low.

Cloud-bursts—concentrated storms of great severity—sometimes take place suddenly in the mountains, in the hottest weather. A cloud may form about a peak, quickly grow dense and black, and give a terrifying electric display. The lightning is followed by a torrent of rain, the character of the resulting flood depending on the relation of the storm to the topography. If it is concentrated in a canyon the result is a violent and spectacular flood wave, of great erosive and transporting power. If it is spread over an open slope, a slower moving and less destructive sheet flood follows the rain. Practically all of the desert erosion is accomplished during brief storms of this kind. Passengers on the railroads through New Mexico, Arizona, and eastern California have occasionally had experience with these cloud-bursts, and have appreciated the force and violence of the floods that result.

At a few points on the desert meteorological observations are made by volunteer observers for the United States Weather Bureau. The following tables will give an idea of the annual temperature and rainfall at a number of widely scattered points.

Temperature at 10 stations in California.

	1903. <i>a</i>			1904. <i>b</i>			1905. <i>c</i>		
	Annual mean.	Maximum.	Minimum.	Annual mean.	Maximum.	Minimum.	Annual mean.	Maximum.	Minimum.
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
Bagdad.....	72.6	113	25	71.6	110	30	.....	119	33
Barstow.....	62.4	110	24	66.8	109	30	65.2	111	18
Bishop.....	55.1	98	4	56.1	97	12	55.0	99	8
Imperial.....	74.6	124	26	.....	115	28	71.5	124	22
Indio.....	.....	118	28	.....	.....	.....	.....	125	20
Keeler.....	64.2	110	14	64.6	112	23	61.8	112	17
Mohave.....	62.7	106	15	67.6	107	23	66.2	114	20
Needles.....	.....	.....	.....	75.7	111	35	57.3	114	26
Palm Springs.....	70.4	117	32	75.6	113	32	70.4	122	28
Volcano.....	74.6	120	25	73.1	117	22	73.6	128	24

a California section of the climate and crop service of the Weather Bureau, annual summary, 1903, pp. 8-9.

b Idem, 1904, pp. 8-9.

c Idem, 1905, pp. 8-9.

Rainfall, in inches, at 10 stations in California.

	Mean annual. ^a		Annual 1903. ^b	Annual 1904. ^c	Annual 1905. ^d
	Years in- cluded.	Amount.			
Bagdad.....			2.32	2.30	9.90
Barstow.....			2.65	0.80	6.40
Bishop.....	1884-1900	4.27	1.56	7.61	5.19
Imperial.....			0.34		10.06
Indio.....	1878-1900	2.43			
Keeler.....	1884-1900	2.76	0.10	3.50	6.80
Mohave.....	1877-1900	4.79	1.87	2.86	6.45
Needles.....	1892-1900	2.79		1.24	11.36
Palm Springs.....	1889-1900	3.53	0.70		9.36
Volcano.....	1889-1900	1.70	0.20	1.90	6.18

^a Monthly Weather Review, vol. 30, No. 4, April, 1902, pp. 208-209.

^b California section of the Climate and Crop Service of the Weather Bureau, Annual Summary, 1903, pp. 16-17.

^c Idem, 1904, pp. 16-17.

^d Idem, 1905, pp. 16-17.

The average rainfall for six years at Bishop, Inyo County, was 3.64 inches; at Camp Cady, on Mohave River, an average of 3.08 inches for two years is recorded. Daggett, San Bernardino County, had an average of 4 inches for three years. At Yuma, Ariz., a twenty-eight year record gives an average of 3.16 inches. It is probably safe to say that the normal rainfall for the desert is between 3 and 4 inches annually, but this average is derived from annual extremes ranging from seasons of no rainfall to those having as much as 10 inches.

WATER SUPPLY.

ORIGIN.

A portion of the rainfall in this region is carried off by evaporation as soon as it falls; another portion soon sinks and joins the ground water, which permanently saturates the rocks below a certain level; still another portion finds its way directly to the streams, which carry it to sinks or lakes to be again evaporated. The moisture that has been evaporated from the surface of the Pacific to float inland as vapor and be condensed again to water the earth is the original source from which practically all of the meager supply of the desert comes, but this does not mean that each spring is dependent on the rainfall in the region immediately around it. Many of the springs of the desert are of deep origin and are not fed by local rains, and the waters that supply them fall on mountains far from the points where they issue.

RIVERS.

Only four of the streams that flow toward the Great Basin from the Sierra Nevada and Sierra Madre extend beyond the base of the mountains. The others sink at once into the sands of the desert.

The waters of Owens River, which heads in the Sierra Nevada north of Mount Whitney, have been secured in part by Los Angeles, and are to be conducted across the desert to supply that city and the surrounding region with pure mountain water. For years a part of the waters that feed this river have been utilized on the fields of stockmen and farmers along its course, but the greater portion has been wasted in Owens Lake, a soda lake that has no outlet.

Amargosa River rises in springs in the mountains northeast of Bullfrog and flows southward intermittently across the desert through Franklin Lake to Resting Springs Dry Lake. On leaving this lake it enters a canyon, about 10 miles long, between Black and Kingston mountains. From this canyon it emerges into the south end of Death Valley and turns westward to Saratoga Springs, whence it flows northwestward to the sink of Death Valley. The north end of Death Valley lies nearly due west of the head of this river, so that the depression as a whole has the form of a long and narrow U. Ordinarily there is water at only a few places along the Amargosa channel, but when a cloud-burst occurs within its drainage area it may become for a few hours a raging torrent. At Resting Springs Dry Lake the stream at such a time has been over a mile wide and several feet deep. But since 1850 the river has not been known to carry enough water to flow on the surface as far as the lowest depression of Death Valley; and in its heaviest floods it rarely extends more than 4 or 5 miles below Saratoga Springs.

The waters of the Amargosa are briny along its lower course. Where it widens out into the large playa at Resting Springs Dry Lake it leaves fields of salt as well as of borax and niter. The desert for many miles on either side of the river is dotted with spots and patches of salt. Hot springs discharge into it at a number of places.

A dry wash marks the channel of the South Amargosa, which rises in Silurian Dry Lake, at the east end of the Avawatz Mountains, and runs northward to Salt Spring. Here it turns northwestward and joins the main river in South Death Valley, a few miles east of Saratoga Springs.

Mohave River rises in the San Bernardino Mountains and flows northward. The Santa Fe Railway follows approximately its course to Daggett. There the river turns northeastward and is followed by the line of the San Pedro, Los Angeles and Salt Lake Railroad until it passes through the canyon at the Caves. East of this canyon it sinks finally in Soda Lake. The divide between Silver Lake, in the Mohave drainage basin, and Silurian Dry Lake, the source of the South Fork of the Amargosa, is but 30 feet high, and consists only of sand. Thus the two river systems are separated by a very low and frail barrier.

Soda Lake, into which the Mohave finally disappears, is known also as Mohave Sink. During the wet season the waters of this lake range from a solution approaching saturation to one containing but 282 parts of solids in 100,000. In the dry season the greater part of the depression is covered with a heavy mineral crust, rich in various salts.

New River rises in Mexico, on the delta of Colorado River, whose overflow waters feed it, and flows northward into the Salton Sink. Other channels across the Colorado Desert have a similar origin and direction. One of these is Salton or Alamo River, which is almost equal in importance to New River. Salton Sink is normally a salt-incrusted depression, whose lowest point is $273\frac{1}{2}$ feet below sea level. For years it was the source of supply of salt for the New Liverpool Salt Company, but it now contains a lake, caused by diversion of the waters of the Colorado to it through the New and Salton channels.

SPRINGS.

In the higher mountains of the desert there are many "hillside" springs, whose source is the rainfall of the immediate neighborhood, but many of these springs are not permanent and are not to be depended on by travelers.

The greater permanent springs are deep seated and many of them probably lie along fault lines. Among the springs of this type whose flow seems to be too strong to be accounted for by local rainfall are those at Pahrump, Manse, and Saratoga.

Probably because of the depth to which the waters of these springs descend during their long subterranean passage, and the heat and pressure to which they are subject, they become active solvents of mineral matter, and issue along the fractures as heated springs, carrying a large percentage of solids in solution.

The waters of many of the desert springs presumably possess valuable therapeutic qualities, and complete quantitative analyses of them are warranted. Other springs furnish only ordinarily wholesome waters, that have acquired a local reputation for the treatment of disease. "Poison springs," said to contain arsenic, have been reported from many parts of the desert. The writer has examined the waters of several of these, but has failed to find any arsenic or similar poison, though he has found large quantities of sulphate of soda (Glauber's salt) and some sulphate of magnesia (Epsom salts). Salt Spring, in South Death Valley, is of this character, and prospectors are known to have perished there, so that the spring is called "poison" by many, but it contains only sodium and magnesium salts, and no arsenic or copper.

The intense heat of the summer, the exhausted condition of the famished prospector, and the abundance of these harmful salts in the waters are sufficient explanation of the deaths that have occurred. Such waters are dangerous to a hearty, healthy man who uses them with the greatest moderation, and they may be quickly fatal to the thirst-tormented sufferer who drinks them without restraint.

FINDING WATER.

CAMPING PLACES.

Many of the springs and wells in the desert may be located without special description, particularly those that are near a main route of travel. Prospectors and mine owners usually enter the field each fall to do assessment work on their mining claims. On these journeys they follow well-established roads or trails and so plan the trip as to stop at the springs where they will find the best water. As fuel is scarce, the ground in the immediate vicinity of the springs is usually so thoroughly cleared of brush as to be practically bare. Near these permanent and well-known springs, piles of tin cans and other débris left by campers are always to be seen. Where the location of such springs is sufficiently obvious, no detailed description of the surroundings is given in the following pages.

The traveler who is unacquainted with the route over which he is journeying should stop at places where the ground has been cleared of brush and where there is other ample evidence of the presence of many visitors, and satisfy himself as to the nature of the camp. It may be a "dry camp," such as are made on long stretches between springs, or there may be a spring or well in the vicinity, which is covered over to keep out animals, and is hidden by drifting sand. Experienced men will have no difficulty in quickly determining the nature of the camp. An inexperienced traveler should not enter the desert alone. If he can not find an experienced companion, he should proceed with the greatest caution, gathering all possible information about his route in advance, keeping himself abundantly supplied with water and food, and never leaving one water station without a definite idea as to the location of the next.

A traveler can rarely see exactly where water is to be found, except by going over the camp ground and looking carefully for wells. Many of the wells are mere shafts, 20 to 40 feet deep, rectangular in shape and covered with a few boards, which may in turn be buried by drifting sand. Only a few wells are equipped with a windlass or pump. These conveniences, even if originally supplied, quickly disappear as fuel for some traveler in need on a cold winter night. He uses them to maintain his camp fire, justifying himself in the belief that self-preservation is the first law.

Prospectors and mine owners often wish to find water in new districts, away from the main lines of travel. In their search for it they must be guided by geologic and topographic conditions and by the vegetation, which is often a useful guide.

MOUNTAIN SPRINGS AND TANKS.

As a rule the water found at high elevations comes from rocks free from alkalies and is pure and sweet. In hunting for these higher springs one must go up to the bare, rocky gulches, above the loose material into which the rain waters sink so readily and are lost. The mountain springs are small and the majority of them disappear during the drier periods, but for a short time after a storm they may be abundant and furnish strong flows.

In the lava or granite ranges water from the winter rains often collects in rock bowls. Where these are in the shade and are protected from the wind, water may remain in them for months after a storm. Such natural reservoirs are known as "tanks." After rains they may be valuable sources of supply for prospectors, but after a series of long, dry seasons they are not to be depended on. Some of these tanks are of large capacity and are very valuable to mining camps. They are so rare, however, that travelers can not expect to find them in an emergency without knowing their whereabouts or their character.

DRY LAKES.

In the vicinity of the dry lakes—the sinks of the desert—water may generally be found by digging or boring wells. These playas are the lowest points in local drainage basins. When the rains in such a drainage basin are heavy enough to induce a surface flow to the depression the waters collect there to sink gradually or to be evaporated. These sinks have no surface outlet, and some of them are rock-floored and have no underground outlet. All of the surplus water of the local watershed is, therefore, impounded in them. Although it may not accumulate at the surface, its quantity is usually sufficient so that comparatively shallow digging will reveal its presence. The supply in such a basin does not depend entirely on the amount of water that reaches the depression over the surface. An important percentage of the lighter rains is absorbed by the *débris* along the flanks of the desert ranges and percolates slowly through the sand and gravel to the playa. A part of the floods resulting from the rare cloud-bursts and heavier storms is also absorbed in the same way and seeks the lowest point in the basin by passage underground through the pores of the gravel.

These accumulated waters may usually be developed by the mining community or by the prospector who wishes to establish a permanent camp. The favorable place for undertaking such development, however, is not in the mud flat—the playa itself—but around its borders. All flowing and percolating waters dissolve alkalies from the rocks, sands, and gravels over and through which they flow. At the point where the waters are evaporated these salts are left behind as saline deposits. As the bottoms of these sinks are merely great evaporating pans, accumulated surface waters and rising subterranean waters both passing into the air there, they are almost invariably alkaline, and usually the alkalies extend to considerable depths. The waters in the center of the sink are impregnated with these salts and are generally not usable. But as the ground waters always percolate toward the lowest point, the waters found about the borders and at short distances back from the playa are relatively pure, since they have not yet entered the highly alkaline area. To reach the water plane at these points about the borders of the sink it may be necessary to penetrate to a greater depth than would be required nearer its center, but usually this is the only way in which potable waters can be developed at such places.

GEOLOGIC HINTS.

As already stated, pure water may be found in springs, pools, and tanks in the areas of granite, lava, or other compact rock. The favorable time to find such water is immediately after the rains or snows of winter. Many of these springs and pools are short-lived, but they furnish water of the best quality, and even immediately after rains no water can be found in the desert valleys, for their sands and gravels absorb the rain as fast as it falls.

Many inquiries are made as to the value of tunneling along a crevice from which a slight seepage escapes, in order to develop a greater supply. Of course it is well to clean out the opening from which the water comes, so that it may flow freely, and to go deep enough to see that none escapes by side channels, but more extensive development work is usually disappointing. If the water of the spring is derived from a saturated body of gravel, tunneling will result in a temporary increase of flow, as the drainage of the gravel body is improved. But in rock even a temporary increase is often not procured, so that there is no return for the expense. A bed-rock tunnel to develop water in arid regions is in the majority of cases a failure. The experience of miners in developing their prospects shows that most of the tunnels that are run into the desert mountains are dry, at least until they have been driven a great distance, and that they develop water only under exceptional conditions.

Next to unconsolidated deposits, the rocks that present the conditions most favorable for direct absorption are uncemented sandstones and certain porous limestones. In granites, slates, and other compact rocks the direct absorption is very slight.

Sandstone is on the whole the best water-bearer among the solid rocks. Under the most favorable conditions the rock is saturated throughout its extent below the regular ground-water level, and water is yielded wherever the sandstone is struck by the drill below this limit.

Conglomerates sometimes furnish water in considerable quantity, although as a rule their absorptive capacity is not so great as that of sandstones, and they are much less commonly encountered.

Sands and gravels are very porous, the free space between the grains occupying from 30 to 40 per cent of the total volume. A mass of such materials is saturated below the permanent water level, and when penetrated by wells yields copious supplies. The waters are generally of good quality, but are at some places mineralized, the mineral matter being derived from the more soluble fragments and particles of the deposits.

Clay is very impervious to water, and usually contains little or none that can be utilized as a source of supply. The water that is frequently reported in clays usually comes from layers that are more or less sandy. Some sands which approach clay in fineness, and which are at times mistaken for it, yield considerable amounts of water. Clay is of the greatest importance, however, in connection with water supply, not as a direct water-bearer, but as a confining layer to porous sands, from which it prevents water from escaping.

Shale, like clay, is a poor medium for the storage and transmission of water, but may yield it from bedding, joint, or cleavage planes. Its most important use is as a confining mass to prevent the escape of water from porous layers which may be interbedded with it.

The water derived from limestones occurs mainly in open channels dissolved in the rock by the water itself. Probably the water originally followed joint or bedding planes, which were gradually enlarged by solution into the caverns now found. The occurrence of caverns and passages within limestone is very irregular and their location can not be predicted. Wells that are sunk in limestone only a few feet apart may show very different results, for a difference of a foot or two in the position of the boring may mean the missing of a particular channel.

Granites and gneisses are dense and possess small pore spaces, and hence hold very little water. Schists, however, may carry water along the foliation planes, but give it up very slowly, and are not, therefore, important sources of supply. The largest supplies from

schists are obtained along joints. These joints are most common near the surface, diminishing in number and in definiteness as depth increases.

VEGETATION AS A GUIDE.

The flora of the usual thoroughly arid sections of the desert varies but little in character. Tracts for miles in extent are covered by an almost uniform vegetation consisting of but a few species that show only here and there slight variations, due to the local differences in the physical or chemical nature of the soil. The presence of water, however, produces marked changes, hence the character of the vegetation is an excellent indication of the possibility of obtaining water near the surface.

At scattered points in the broader valleys or in the more restricted gulches are numbers of dead sycamores or cottonwoods. Their presence usually indicates the lowering of the water table in that region, and it is not likely that a supply will be found within 20 feet of the surface.

The dry lakes are nearly all absolutely free from vegetation. This lack is probably due to the intermittent flooding of the surface, to the frequently renewed deposits of mud, and to the excess of alkali present.

Although mesquite (*Prosopis juliflora*) grows luxuriantly where water is abundant, its presence is not a good guide to water, for its growth may depend on either the proximity of the ground water or the periodical flooding of a small area. Where its growth is due to ground water it furnishes no suggestion as to the depth to the water. It may lie within a few feet of the surface or it may be 50 feet below. Where its life is sustained, as in restricted gulches, by occasional floods, obviously water will not be found by digging during the drier periods.

Tules, or bullrushes, always indicate water at or very near the surface, and generally water of good quality.

Lowland purslane (*Sesuvium portulacastrum*) is a plant that grows on moist alkaline soils. It indicates water, but usually water of poor quality.

Wild heliotrope (*Heliotropium curassavicum*), sometimes called "Chinese pusley," is one of the rarer plants. It grows only in moist soil, but since it has strong alkali-resisting powers the water near it may be brackish.

Arrowweed (*Pluchea sericea*) is another moisture-loving plant found in the desert. Where it grows to a height of 6 or 8 feet in a dense tangle it is reasonably certain that the ground water lies within 20 feet of the surface and that its quality is at least fair.

Salt grass (*Distichlis spicata*) indicates water very near the surface, but this plant prefers alkaline areas, although not confined to them; hence the water indicated by it may be very brackish.

Creosote (*Larrea mexicana*) and the numerous shrubs (*Sarcobatus*, *Grayia*, etc.) of the greasewood group, which are widely distributed over the deserts, grow in the driest of soils, and although some of them, like creosote, flourish better with a moderate amount of water their presence may generally be taken as an unfavorable indication.

HINTS ON DESERT TRAVELING.

TEAMS, HAY, AND GRAIN.

Where teams are used animals accustomed to the desert should be procured, if possible, for horses or mules that are unused to desert conditions fret on the sandy roads and rapidly weaken from drinking the saline waters. They are also in danger of pneumonia from the cold of the winter nights and the wide extremes of temperature. During winter journeys blankets should be provided to protect the animals at night.

Travel in the desert far from the railroads and from food supplies is, of course, more expensive than in other regions. A party leaving a supply station to go 100 miles or more into an uninhabited part of the desert must take along everything needed, even to the most minute detail. This means that if the trip is to last for two weeks enough hay and grain for each animal and enough provisions to last each man that length of time must be taken. For four horses, drawing a wagon that carries four persons and their bedding, provisions, and tools, another team of four horses must also be taken to haul sufficient hay and grain to feed the eight horses for two weeks. There are but few places in the desert, away from the railroads, where grain or hay of any kind can be procured. As the teams are rarely able to travel faster than a walk, heavy horses that are good walkers should be selected. The tires should be as wide as can be procured. Desirable widths of tires for freight wagons are 6 to 9 inches; for light wagons 3 inches.

A good feed trough may be made as follows: Take two pieces of surfaced 2 by 4 lumber, about 4 feet long. Cross them in the form of an X and fasten them together with a bolt, so that they can be folded for packing in the wagon. Near the top of each arm of the X fasten a heavy hook to which a canvas may be attached. This X should be fastened to the end of the wagon tongue, and a piece of canvas properly shaped should be stretched from it to the front wheels of the wagon to form a broad trough. The tops of the cross-bars should be fastened together with rope to keep them from spread-

ing; the bottoms should rest on the ground. Both hay and grain should be fed from such a trough, which saves waste and provides a more healthful mode of feeding than eating out of the dirt. Nose bags may be carried for feeding grain during the short stops at noon. For packing trips experienced prospectors select burros on account of their endurance of heat and thirst, their foraging abilities, and the slight amount of care they require. They are slow and too light to carry heavy packs, so that on expeditions where speed is essential, or heavy freight is to be moved and feed is available, horses or mules are to be preferred.

TOOLS.

Travelers will often find springs choked by débris washed in by rain storms or contaminated by the bodies of desert animals that have fallen in and drowned. It is therefore necessary to provide a pick, shovel, bucket, and rope for cleaning the wells.

CLOTHING, BEDDING, ETC.

At all times except in midsummer—when the desert should be avoided—the traveler must be provided with clothing suitable for both extreme heat and extreme cold. His route over a part of the journey may extend through heated valleys that lie near sea level, or he may have to camp in the mountains, at elevations of 3,000 to 6,000 feet, where the temperature may fall nearly to the freezing point before morning. For protection during the early morning hours he must therefore have warm, heavy blankets and a heavy overcoat or its equivalent. Many cases of pneumonia and “mountain fever” have been caused by extremes of temperature for which no adequate provision had been made. In winter the temperature in this region may reach 85° or 95° during the day and fall to the freezing point before midnight. The traveler should be provided with a canvas sheet that is long enough to lay under his bedding and fold back over it, as well as to cover his head in case of sand storms. Folding cots and air mattresses are luxuries that may be taken if the financial resources of the party are sufficient to provide such supplies and ample means of transportation.

The outer clothing should be of a color that will reflect as much heat as possible—that is, white, gray, or yellow—and the under-clothing should be of wool. The hat should have a wide brim and be thick enough to exclude all rays of the sun. The proper headgear is a broad-brimmed gray felt, or, for summer wear, a big opaque helmet of white or khaki color, the bigger the better. The hair should not be cut very short, as it is a natural means of protection.

Travelers with their own outfits and a minimum means of transportation will find that they must walk much of the time, for teams with

heavy loads can only crawl through the sands at the rate of 2 to 3 miles an hour. Sand and sharp flints will wear out the soles of boots and shoes very rapidly. Hence stout hobnailed footwear should be worn.

PROVISIONS.

In the more important mining camps and at the principal railroad points there are eating houses, where the traveler who follows railway and stage lines may procure food; but in actual desert travel in regions far away from these few local points full provision must be made at the outset for the entire period to be occupied in the journey. The staples of camp supplies, such as flour, sugar, tea, coffee, rice, bacon, beans, breakfast foods, etc., are well known, but means and personal taste will to a great extent dictate the further choice. The monuments of tin cans at the various camping places testify to the popularity of the various foods preserved in tin. The better brands of canned meats, fruits, and vegetables are excellent and will form an important and most refreshing part of the menu of the more elaborately equipped parties. Where long journeys are planned and transportation facilities are limited, canned goods must be eliminated, largely because of their weight, and dried foods substituted. Soups, meats, potatoes, and other vegetables, as well as fruits, may be had in dried form, and a considerable range of choice is possible. Condensed cream is recommended, even where it is necessary to economize in weight, for it not only makes possible a much wider range in cooking, but it counteracts in great measure the irritation produced in the digestive tract by the alkaline desert waters, and is therefore especially desirable.

WATER.

Owing to the intense heat of the desert there is a rapid and abundant growth of minute forms of animal and vegetable life in waters that are not too saline. All water should therefore be boiled before drinking. Filters form a part of the more elaborate outfits. There are now on the market several small, compact filters from which the traveler may select such as he may think desirable. It is not practicable to distill water except for mining camps or for large parties.

It is advisable to drink heartily in the morning and at night and as little as possible during the day. The practice of drinking water in excess of the amount necessary to relieve thirst may easily become a habit and should be avoided. At best it places an unnecessary tax on the system, and, when alkaline waters are used, may easily result in illness that could have been prevented by the exercise of greater foresight and self-control. It has been recommended that raw oatmeal be placed in the canteens, and some travelers even add to this a

small quantity of chocolate and sugar. When the water becomes tepid, additions of this kind make it more palatable to some, and there is less temptation to drink too much. It is well, also, during periods of extreme heat to wrap a wet cloth around the wrists and to put a water-soaked handkerchief in the hat. These are old-fashioned but effective devices. Each person in a party should be supplied with a large canteen, and extra ones should be taken along in the wagons to provide for leaks and accidents. An ample supply of water barrels and kegs should also be carried for use at dry camps and during prospecting trips, the number depending on the amount of stock taken and the route followed.

FUEL.

Fuel is scarce in the desert, especially in the vicinity of the better-known springs, where it has been entirely cleared away. The traveler therefore usually finds it necessary to begin gathering brush and mesquite roots long before he reaches a spring, so as to provide fuel for cooking. Camp fires are luxuries that can be indulged in only among heavy mesquite and cottonwood timber, or off the beaten lines of travel.

GETTING LOST.

One unacquainted with the desert should accustom himself to its clear air and the resulting exaggerated detail, which makes distant objects look near. No walks without water or provisions to what appears to be a near-by hill should be undertaken without definite knowledge of its distance. Landmarks should be studied, so that they will be recognized from any point of view, that they may be known when they are reached again. Before he begins a journey that does not follow a beaten and unmistakable track, the traveler should determine his general direction by compass or map or inquiry, and should adhere to that direction. The inexperienced traveler often gets at once into a panic on losing his way, and wastes his remaining energy in frantic rushes in one direction and another. This tendency to become panic-stricken should be controlled, if possible. Sit down, get out your map and compass—if you are provided with them, as you should be—and study the situation carefully before acting. At least, rest a little and think it over. If it is hot and you are far from camp, get your head into the shade of a bush or rock, and wait till night. Thirst will be less intolerable then and endurance greater. If you have camp companions who are likely to look for you, start a signal fire by night or a smoke by day from some little eminence, and then stay by it until help comes. If you must depend on your own exertions, think carefully over all the possibilities and adopt a plan of action and adhere to it. Remember the proneness of the lost person to exaggerate the distance he has trav-

eled. It is well to count paces and to remember that about 2,000 make a mile. You will thus have a good check on the distance that you go, and at the same time will keep your mind occupied. Keep your direction true by traveling toward or from some selected landmark, or by the sun during the day or a star at night, or by keeping with or against or in some fixed direction in relation to the wind. If you think these things out and have studied the country beforehand, so that you know the relation of a road, or a ranch, or a spring, or a river to a given landmark or to the points of the compass, you should have no difficulty in finding your way again. With some persons, however, the faculty of getting lost amounts to genius. They are able to accomplish it wherever they are. The only suitable advice for them is to keep out of the desert. There are safer places in which to exercise their talent. Still others have a geographic instinct and a power of geographic observation which defies time and place. They can not be lost anywhere. For such these lines are not written.

MAIN ROUTES OF TRAVEL.

STARTING POINTS.

Most of the main routes of travel in the desert are by no means straight, but make long detours, their courses having been determined either by the location of watering places or by the desire to avoid crossing desert ranges. A long way round to a given place on the desert may be not only easier but safer than a more direct line. Nearly all the travel into these regions starts from the Santa Fe, Salt Lake, or Southern Pacific Railroad, and the descriptions that follow are given accordingly. In returning from his destination the traveler has only to retrace his steps.

FRÉMONT'S TRAIL.

Gen. J. C. Frémont, in April, 1844, entered the Mohave Desert at Cameron Salt Lake, about 22 miles northwest of the modern town of Mohave. From that point he followed the east base of the Sierra southward to what is now known as Water station. Thence his course was southeastward past the Desert Buttes, until he reached Mohave River at "Point of Rocks," near what is now known as Cottonwood station, on the Santa Fe. There he turned down the Mohave to the point where the old Spanish trail left it, about 10 miles east of Otis. From that point he followed the old Spanish trail northeastward to Tomaso Springs; thence northward past the east edge of the Avawatz Mountains to Salt Spring and the canyon of the Amargosa, which he followed up to China Ranch Springs, on Willow Creek. From China Ranch Springs he journeyed to Resting

Springs, where his course was altered to the northeast toward Vegas Warm Springs, in Nevada. This route between Cottonwood, Otis, and Resting Springs is still used.

OLD SPANISH TRAIL.

When California belonged to Mexico, caravans made regular trips over a well-defined trail that connected Los Angeles with points in Utah. This trail crossed the mountains north of San Bernardino by the Cajon Pass, and followed Mohave River down to a point east of the Calico Mountains. There the trail forked, one branch leading across the east edge of Alvord Mountain to Bitter Spring and Tomaso Springs and thence northward along the east edge of the Avawatz Mountains to Salt Spring, the other branch continuing down the Mohave to its sink, then crossing Soda Lake and Silver Dry Lake and joining the first branch in the pass between the Avawatz and Shadow mountains. From Salt Spring the trail led northward through the canyon of the Amargosa to Resting Springs, then eastward by way of Stump and Crystal Springs to Las Vegas Warm Springs, where it turned northeastward to Virgin River. This route was used later as the mail route from Los Angeles to Salt Lake City, mail being carried over it once a month for many years.

These roads are still used by travelers from Daggett to Shadow and Silurian mountains or to Soda Lake.

MOHAVE-KEELER ROUTE:

Those who desire to reach points in the western part of Inyo County will find the stage road from Mohave to Keeler the best route. It is an old-established, easily followed road, and watering places and road houses are distributed along it. It follows close to the foot of the Sierra Nevada from Mohave station on the Santa Fe and Southern Pacific railroads, northward to Water station, whence it passes through Redrock Canyon, at the west end of the El Paso Range, and on northward to Freeman, Indian Wells, Little Lake, Haiwee, and Olancho. From Olancho one road skirts the west side of Owens Lake to Lone Pine and Independence, the county seat of Inyo County. From this route, as shown by the map (Pl. I), other roads lead eastward to most of the mining districts.

DEATH VALLEY ROUTES.

There are three main routes by which Death Valley may be reached from the south. One starts from Johannesburg, another from Daggett, and a third from Barnwell.

The Johannesburg route runs by way of Blackwater and Granite Wells. A heavily laden team can leave Johannesburg late in the

morning and reach either of these camping places in the evening. A dry camp should be made between Granite Wells and Leach's Spring, the next watering place, as the distance is 45 miles, and pulling is hard over the last 6 miles on account of deep sand and heavy grades. From Leach's Spring the route leads to Owl Springs, Saratoga Springs, the China ranch, and thence to Resting Springs. At Resting Springs directions should be obtained for going to the head of Furnace Creek, whence the route follows down Furnace Creek to the Borax Works at Coleman, in Death Valley.

The Daggett route is a favorite with many. This road runs from Daggett to Otis, thence east of the Calico Mountains to Coyote Well, and across the dry lake to Langford Well and Garlic Spring. From this spring the road passes to the east of the Granite Mountains and climbs the Avawatz Mountains to Cave Springs. From Cave Springs it leads to Saratoga Springs and thence to Resting Springs.

The Barnwell route was for a number of years traveled by a daily stage running from Barnwell, Cal., to Manse, Nev., but the stage has been abandoned since the construction of the Salt Lake Railroad. This route is still preferred by some travelers, who obtain their supplies at Barnwell or at Ivanpah. From Ivanpah the road extends across the dry lake to the north, thence through the State Line Pass to Mesquite Dry Lake and Sandy; from Sandy northwestward to Stump Spring and Manse; thence to Pahrump and Johnnie and Miller Well No. 2, where it joins the stage road from Las Vegas to Bullfrog.

Outfits may also start from Roach or Jean, Nev., and go westward to Sandy. At Pahrump, on this line, roads branch to the Fairbanks ranch at Ash Meadows, but it is advisable to go by way of Johnnie to Miller Well No. 2, and thence to the Fairbanks ranch, where there are springs. A number of recent changes and improvements in the roads give good routes to the head of Death Valley. Travelers can obtain all information regarding these changes at Pahrump and at the Fairbanks ranch.

BULLFROG ROUTES.

Three main routes lead to the Bullfrog mining district, from Las Vegas, Ivanpah, and Goldfield. Travelers over the Death Valley routes can connect with the Bullfrog roads by driving from Resting Springs to Manse, Pahrump, or the Fairbanks ranch.

A wagon road runs from Las Vegas, Nev., northwestward by way of Tule Spring to Indian Springs, thence westward to Miller Wells Nos. 2 and 1, and northward to Beatty, Rhyolite, and Bullfrog. This route is 130 miles long.

Ivanpah is the terminus of a branch of the Santa Fe Railway which leaves the main line at Goffs (Blake post-office), Cal. From

Ivanpah a stage line runs northward by way of Sandy, Manse, and Pahrump to Miller Well No. 2, where it connects with the Las Vegas road. This route is highly regarded, as the water supply is excellent, and hay and grain can be obtained at the four stations mentioned. Bullfrog is about 135 miles in air line northwest from Ivanpah.

A wagon road runs from Goldfield to Bullfrog by way of Cuprite and Bonnie Claire station, which lies on the west side of Sarcobatus Flat. From Bonnie Claire station the stage follows the east foot of the Grapevine Mountains, by way of the Tonopah Well, Seattle Well, and the old town of Bullfrog, entering the new town of Bullfrog from the west. This route is about 80 miles long.

SEARCHLIGHT ROUTE.

The Searchlight mining district is best reached by a branch of the Santa Fe that leaves the main line at Barnwell.

NEEDLES-PARKER ROUTE.

The southeastern portion of the Mohave Desert is best reached by the road running from Needles southward to Parker. Two wells, dug by the county, and known as the "old" and the "new" West wells, furnish water to the traveler. There are no settlements on the route. The completion of the Santa Fe line now under construction from Bengal to Parker will give easier access to this district.

AMBOY-DALE ROUTE.

A stage line connects Amboy, on the Santa Fe Railway with the Dale mining region to the south. Water can be had at the stage station along the line.

MECCA-DALE ROUTE.

An excellent road starts from Mecca, in the Coachella Valley, on the Southern Pacific Railroad, and runs northeastward to Shaver well, thence along the west flank of Eagle Mountains and the east side of Pinto Mountain to Dale. This road is well supplied with good water, and is the main route into this region from the south.

VICTORVILLE ROUTES.

Victorville station, on the Santa Fe Railway, is the starting place for points in the southern portion of the Mohave Desert east of the Santa Fe. A county road crosses Mohave River here by a good bridge, and branches of this road run along the east side of the river to the various mining camps. The main county road runs eastward by way of Dead Man's Point, at the south end of Granite Mountain, to Box S ranch. At this ranch the road forks, a northern branch lead-

ing eastward by way of Old Woman Springs, Mean's Well, and Surprise Spring to Twenty-nine Palms Springs and Dale. The southern road goes by way of Box S Springs, Cushenbury Springs, and the Rose Mine to Twenty-nine Palms Springs. This road crosses the northern edge of the San Bernardino Range, rises to high altitudes, and has heavy grades. The northern route is the better.

BANNING-DALE ROUTE.

From Banning a wagon road runs by way of Warren's Ranch, Warren's Well, Coyote Holes, and Twenty-nine Palms Springs to Dale.

IRRIGATING AND ARTESIAN WATERS.

IRRIGATED AREAS.

The arid region shown on Plate I is bounded on the east, west, and south, respectively, by Colorado River, the Sierra Nevada, and the Sierra Madre. The only places in this wide area where irrigation is generally practiced are found along the east base of the Sierra Nevada in Inyo County; in the Elizabeth Lake, Palmdale, and Little Rock districts north of the Sierra Madre in Los Angeles County; in a few small tracts along Mohave River in San Bernardino County; in the Imperial district in Imperial County; the Indio section in Riverside County, and at a few points along Colorado River. In the desert proper the patches reclaimed by irrigation vary in size from 4 or 5 acres to 160 acres, and are isolated and exceptional, serving only to emphasize the barrenness of the rest of the region. These oases are all watered from springs and will be mentioned in the detailed descriptions.

ARTESIAN WATERS.

Certain areas give evidence of having a supply of artesian water as yet undeveloped or but partly developed, but their exact limits and the amount of water available in them can be ascertained only by special study. The writer desires to call attention to the fact that they exist and that some of them are worthy of detailed investigation.

Artesian zones border some of the larger playas or dry lakes which have a relatively abundant water supply. Near the southern and western limits of the Mohave Desert there are several such basins whose waters are supplied by the run-off from the Sierra Madre and Sierra Nevada. An important basin of this type exists also in the northwest arm of the Colorado Desert, about Indio, where several thousand acres of land are under irrigation by the use of artesian waters.

In addition to water in sufficient quantity to give the necessary head, certain mechanical conditions, such as a proper alternation of pervious and impervious strata, are necessary to establish and maintain artesian conditions. Furthermore, such basins in the desert are usually readily exhausted, because the amount of water available to replenish that drawn out for irrigation or other uses is small. In planning municipalities, large mining camps, or extensive irrigation from such waters, care must be taken that their quantity is not overestimated.

Artesian waters have been obtained near Haiwee, in Inyo County, between the Sierra and the Coso mountains; at the head of the Salt Wells Valley between the El Paso Range and the Sierra; and west of Kane Dry Lake in Kern County. Another belt in which artesian waters have been developed lies along the north edge of the Sierra Madre in Los Angeles County, in the vicinity of Lancaster. Other artesian belts lie east of the latter zone along the north front of the San Bernardino Range, in the neighborhood of Victorville and farther east in what is known locally as the Lucerne Valley district. The principal wells drilled in this valley are mentioned under the heading "Box S ranch."

Artesian waters have been tapped in the northeast corner of Riverside County, in T. 2 S., R. 19 E., San Bernardino meridian. They have been found also on the northeast edge of the basin, of which Rodriguez Dry Lake is the sink, at the Flowing Wells.

DESCRIPTIONS OF SPRINGS.^a

SYMBOLS USED.

Springs, wells, flowing wells, and pumping plants are represented on the map by appropriate symbols, and those described in the text are given numbers; others, whose locations are known but for which no descriptions are available, are indicated by symbols only.

In the arrangement of the descriptive matter the plan adopted is to divide the map into rectangles, each covering an area of approximately four townships. These rectangles are identified by letters and numbers along the margins of the map. The numbers and the corresponding descriptions in the text begin at the northwest corner of the map and follow the first row of rectangles eastward to the Nevada line. They then begin in the next row of rectangles to the south and follow it eastward. When all of the descriptions available for California have been given in this order, the same plan is adopted for that part of Nevada described, but the California and Nevada numbering is continuous. Locations can not be given by land lines, because there are many unsurveyed areas in the desert, and even

^aArranged by map numbers. References to positions on the map, in parentheses, follow the headings.

where surveys have been made they are old, much of the work having been done between 1852 and 1860, and corners are usually missing. Both on this account and because of the very general way in which many of the springs have been located it is not possible to give the section within which they are found.

CALIFORNIA.

1. *Oasis, Mono County (A-2).*—Oasis is a settlement near the California-Nevada line west of the Palmetto Range. It is about 30 miles northeast of Alvord station, on the Southern Pacific Railroad, and about 15 miles northeast of Deep Springs (No. 2). Oasis serves as a general outfitting point for prospectors in the Palmetto Range. It is well supplied with water from both springs and wells.

2. *Deep Springs, Inyo County (A-2).*—At the south end of Deep Springs Valley there are large flowing springs that have been known since the earliest settlement of the north end of Inyo County, and that have given a name to the settlement and to the valley. They are 13 miles east of Poleta station and about 18 miles northeast of Alvord station, on the Southern Pacific Railroad. They furnish sufficient water to irrigate about 600 acres. The settlement is the principal stopping place between Alvord and Oasis.

3. *Sand Springs, Inyo County (B-3).*—Sand Springs are about 19 miles west of south, in an air line, from Lida, Nev., on the west side of the north end of Grapevine Mountains. They are in Termination Valley near its north end, about 16 miles northwest from Staininger's ranch (No. 5). The water is good, and the site of the springs is marked by the débris left by many campers.

4. *Grapevine Springs, Inyo County (B-3).*—This is a group of springs on the bench above the floor of Death Valley, about 3 miles by trail due west of Staininger's ranch. There is plenty of water.

5. *Staininger's ranch, or Grapevine ranch, Inyo County (B-4).*—This ranch is in Grapevine Canyon, which drains into Death Valley, about 22 miles southwest from Bonnie Claire station, on the Las Vegas and Tonopah Railroad. It is about 11½ miles, air line, northwest of Grapevine Peak. There is an unlimited supply of good water.

6. *Barrel Springs, Inyo County (C-1).*—There are springs of excellent water in Mazourka Canyon in the Inyo Mountains, about 10 miles northeast of Independence and 6 miles north of Citrus station, on the Southern Pacific Railroad.

7. *Cold Springs, Inyo County (C-3).*—There are two groups of springs near together in the northeast portion of T. 13 S., R. 39 E., about 10 miles northeast of the Saline Valley borax works (No. 13). The springs of one group yield hot water, those of the other cold water. The hot springs lie farther south than the cold. The water

from the springs of both groups is of good quality, and there is a sufficient quantity, if developed and conserved, to irrigate several acres.

8. *Rest Spring and Burro Spring, Inyo County (C-3).*—Rest Spring is in a shallow gulch at the head of a canyon draining southward and westward into Butte Valley. It is one-half mile west of the summit of the Panamint Range and 15 miles north of Goldbelt Spring (No. 15), to which there is a plain trail. It is $6\frac{1}{2}$ miles south of Tin Mountain, the northernmost peak of the range. The flow is about 3 barrels of water daily. A trail running due north leads to Burro Spring, $1\frac{1}{2}$ miles distant. This spring is in a shallow gulch at the head of a canyon draining southward and eastward into Death Valley, one-fourth of a mile east of the divide. This spring also yields about 3 barrels of good water per day.

9. *Mesquite Spring, Inyo County (C-4).*—This spring is in the east bank of the wash in Death Valley, one-half mile from the bottom. It is 6 miles southwest of Staininger's ranch, 19 miles southeast of Sand Springs, and 11 miles northwest of the locality known as Lost Wagons. There are other springs in the desert portion of California and Nevada that are also known as "Mesquite" springs.

10. *Indian Springs, Inyo County (C-4).*—Like "Mesquite," the name "Indian" is applied to several desert springs. Those here referred to are near the northeast end of the great Panamint Range and near the south end and west side of Termination Valley on an old and little-used trail that runs southward from Lida, Nev., by way of Sand Springs to the north end of Death Valley. They are marked by remains of Indian tepees. There are said to be other springs in this vicinity, but their location is unknown except to local prospectors.

11. *Tule Spring, Inyo County (C-5).*—This spring is about 3 miles south of west, air line, from Willow Spring (No. 12) and 12 miles southwest of Bullfrog, Nev. It is on the north side of the east branch of a canyon at the foot of a cliff, $1\frac{3}{4}$ miles southeast of the high, sharp, rocky Thimble Peak. It is about 500 yards east of the trail from Bullfrog to Surveyors' Well (No. 18) by way of Willow Spring (No. 12). There is a very small quantity of excellent water. There is another Tule Spring to the southeast, near Tecopa.

12. *Willow Spring, Inyo County (C-5).*—This spring is on the east slope of the Grapevine Range, 9 miles southwest of Bullfrog, Nev., and 3 miles north of the Boundary Canyon road at the pass. The flow is 10 barrels of good water daily. There are at least 8 watering places in the desert region with which this paper deals that are known as Willow Spring or Willow Springs; so this is by no means a determinate name.

13. *Saline Valley Well, Inyo County* (D-2).—Twenty years ago Conn & Trudo manufactured borax on an old dry lake in Saline Valley, and dug a well near the works that furnished a good supply of water of fair quality. The well is still used by prospectors on their way to the copper regions on the eastern side of Saline Valley.

14. *Bird Spring, Inyo County* (D-3).—There is a spring of pure water on the trail from Keeler to North Death Valley near the mouth of a canyon on the east side of the Pinto Mountains.

15. *Goldbelt Spring, Inyo County* (D-4).—Goldbelt Spring is near the head of a western branch of Cottonwood Canyon, known as Marble Canyon. It is 8 miles by trail northwest of the head of Cottonwood Creek, 4 miles northeast of the crest of the Panamint Range, and nearly 25 miles southwest of Surveyor's Well (No. 18) in Death Valley. The spring, which is surrounded by bushes, is on the south bank of the canyon, about 100 feet above the bottom of the wash. It flows about 20 barrels per day.

Two miles east of Goldbelt Spring, and down the canyon from it, is a small spring in a clay bank on the south side of the wash. It yields perhaps 3 barrels per day.

16. *Well, Inyo County* (D-4).—This well is 7 miles southwest of Surveyor's Well, on the southwest edge of Mesquite Flat, south of the trail from Surveyor's Well to Cottonwood Canyon. The trail is often buried in sand and obscure, and the water is not always easy to find.

17. *Ring or Ruiz Well, Inyo County* (D-4).—This well is 2 miles southwest of Surveyor's Well, in the Mesquite Flat that occupies this portion of Death Valley. The trail to it may be buried in sand, and the water difficult to find. The well is 4 feet deep, and the water good, although slightly brackish.

18. *Surveyor's Well, Inyo County* (D-4).—This well is at the northeast corner of Mesquite Flat, on the main road from Staininger's ranch to Furnace Creek. It is 19 miles southeast of Mesquite Spring, 8 miles southeast of the locality known as Lost Wagons, and 20 miles southwest of Bullfrog in an air line. The position of the well is clearly marked by camp débris. The well is 5 feet deep and the water obtained from it is good, although slightly brackish. A trail leads from it southwestward to Marble Canyon.

19. *Triangle Spring, Inyo County* (D-4).—This spring is 3 miles southeast of Surveyor's Well, on the road from Staininger's ranch to Coleman (Furnace Creek ranch), 5 miles northwest of Stovepipe Wells (No. 20), and one-half mile east of Sandy Flat. It is in a clay bank, marked by a growth of mesquite. There is a small quantity of good water.

20. *Stovepipe Wells, Inyo County (D-4).*—These wells are near the intersection of the Bullfrog-Ballarat and Staininger-Furnace Creek roads, 25 miles southwest of Bullfrog. They are on the eastern edge and near the south end of Mesquite Flat, 6 miles southwest of Death Valley Buttes. The main road southeastward from them leads to Furnace Creek; the one to the northwest to Grapevine Canyon; the one to the northeast to Rhyolite, Nev., by way of Boundary Canyon; and the one to the southwest to Keeler, by way of Emigrant Canyon. There are two wells about 5 feet deep that yield an abundance of good water.

21. *Daylight Spring, Inyo County (D-5).*—This spring is just north of the pass in the Grapevine Range, on the wagon road from Bullfrog, Nev., to Furnace Creek and Ballarat, Cal. It is about 10 miles southwest of Bullfrog. The spring is 300 yards west of the road, on the side of the hill. The flow is about 8 barrels of good water per day.

22. *Keane Spring, Inyo County (D-5).*—This spring is on the west slope of the Grapevine Range, about 3 miles a little east of south of Daylight Spring and 4 miles northwest of the Chloride Cliff mine. It is accessible by wagon from Boundary Canyon by the road turning east up the first large wash south of Daylight Spring. The flow is 30 barrels of good water per day.

23. *Hole in the Rock Spring, Inyo County (D-5).*—This is a seep in a hole which may contain 6 or 8 gallons of water. It is about 5 miles southwest of Daylight Spring, one-half mile north of the wagon road in Boundary Canyon, and 3 miles northeast of Death Valley Buttes.

24. *Salt Creek Wells, Inyo County (D-5).*—These are two small wells in sandy earth at the foot of a low hill near the east edge of Salt Flat. They are about 5 miles southeast of Stovepipe Wells on the road to Furnace Creek ranch. The road to Ballarat turns west and crosses Salt Creek here. The water in the creek is very salty; that in the wells is brackish, but usable.

25. *Poison Spring, Inyo County (D-5).*—This spring is 11 miles east of north of the Furnace Creek ranch (Coleman) in the bottom of a very narrow limestone canyon, the deepest in the vicinity. It is 250 yards northeast of the trail from Furnace Creek ranch to Bullfrog via Indian Pass and Amargosa Desert, and is difficult to find. There is a small seep of water, which may be used in limited quantities.

26. *Springs (no name), Inyo County (E-2).*—There are a number of springs near the southeast edge of Owens Lake, which have long been known to the stockmen of that region. The springs rise from the alluvium that surrounds the lake, and the water is brackish. It is too full of mineral matter to be palatable, but serves for stock, and is a watering place on the Mohave-Keeler stage road.

27. *Cottonwood Creek, Inyo County (E-4).*—Cottonwood Creek, a stream of fine, clear water, rises in a large spring about 10 miles above

the mouth of Cottonwood Canyon and flows about 2 miles before disappearing. The canyon opens into Death Valley 11 miles southwest of Surveyor's Well and 11 miles almost due west of Stovepipe Wells. The main trail from Death Valley to Keeler via Bird Springs and Cerro Gordo follows it.

There are a number of small springs in the upper branches of Cottonwood Canyon. One is $3\frac{1}{2}$ miles west of the head of Cottonwood Creek, in a side canyon just south of the main western branch. Another is 5 miles above the head of Cottonwood Creek, in the main canyon, on the main trail from Death Valley to Keeler. Still another is $1\frac{1}{4}$ miles northwest of the last, across the divide, 300 yards from the trail, in a small flat.

28. *Emigrant Springs, Inyo County* (E-4).—Emigrant Springs, which have been used since 1852, are in the northern portion of the Panamint Mountains, nearly opposite the north end of the sink of Death Valley, and about 20 miles west of the mouth of Furnace Creek. They are in Emigrant Canyon, the main pass through the Panamint Range, on the wagon road from Ballarat to Death Valley, Chloride, and Bullfrog. This road also passes Wild Rose Spring (No. 42), which is about 14 miles south of Emigrant Springs. Emigrant Springs receive their name from the fact that they were used by the early emigrants from Salt Lake City, who entered Panamint Valley by this route. They are in a canyon draining northward into Death Valley, at the north end of Tucki or Sheep Mountain, 19 miles from Surveyor's Well, in a wash at the foot of a limestone wall 20 feet high, 25 yards west of the wagon road. The supply is about 50 barrels of good water per day.

29. *Spring (no name), Inyo County* (E-4).—This is a small spring in the mountains about 3 miles east of Wild Rose Spring. It is in a canyon off the main road that passes Wild Rose Spring, about 2 miles from the road. There are a number of other springs, known to prospectors, on the west side of the Panamint Range, but they are away from traveled routes.

31. *Salt Well, Inyo County* (E-5).—This well is on the road from Furnace Creek ranch to Stovepipe Wells. It is 10 miles northwest of the ranch and 4 miles southeast of Stovepipe Wells. The water, which is too salt for human beings, but may be used by stock, is obtained from a hole in a clay bank 100 yards west of the main road. Well No. 61 is another "salt well," about 10 miles northeast of Searles, on the road between Johannesburg and Ballarat. Salt Spring (No. 75) is in the extreme southeastern end of Death Valley.

32. *Fountain Springs, Inyo County* (E-5).—There are small springs at the east edge of the butte that lies just east of the sink of Death Valley, about 6 miles north of Coleman. They are used by prospectors and miners in the Amargosa Range.

33. *Coleman Springs, Inyo County* (E-5).—Coleman was originally known as the Greenland ranch. It is now better known as the borax camp of the Pacific Coast Borax Company, and is the point from which the much advertised "20-mule teams" once hauled borax across the desert to Mohave. The springs are near the northeast end of the sink of Death Valley, at the mouth of Furnace Creek, about 50 miles by wagon road via Boundary Canyon south of Bullfrog. The water, which is abundant, is used to irrigate over 100 acres of alfalfa. It contains some saline matter, but is not unpleasant to taste and is used without injurious effects during the winter season, the only time when work is carried on in Death Valley.

The springs are about 200 feet above sea level, and are reached by two roads from Fairbanks Ranch, Nev., one running nearly due west across the Funeral Mountains to Furnace Creek and down its canyon; the other passing south of the Funeral Mountains, by way of Franklin Dry Lake, to the head of Furnace Creek Canyon.

The old route from Coleman to Mohave crosses the sink of Death Valley to Bennet's Wells (No. 44) by a road formed by crushing the hummocks of salt that cover the valley floor. From Bennet's Wells this road follows the west side of the valley to the south end of the sink, then turns southwest through Windy Gap to Lone Willow Spring (No. 65) and passes on by way of Granite Wells (No. 96) and across Willard Dry Lake to Mohave. This road is in many respects the best through Death Valley. The chief objection to it is the long drive of over 50 miles to Bennet's Wells from Lone Willow Spring without water.

Travelers are cautioned not to attempt to reach Coleman from Saratoga Springs (No. 74) by traveling down the valley of the Amargosa, unless they have a guide who knows just where to find the Confidence Springs (No. 49) in the Amargosa Range near the Narrows. These springs are 7 miles north of the ruins of the old Confidence Mill. Two trails run northward from this mill; the one that branches to the east goes to the old mines and the one to the northwest goes to the springs. As this is the only water for nearly 70 miles on a poor road the trip is a dangerous one, to be avoided under all ordinary conditions. (See "Death Valley routes.")

34. *Cow Creek, Inyo County* (E-5).—This stream, formed by the flow from constant springs, is in the canyon on the west slope of the Funeral Range, 8 miles northeast of Furnace Creek ranch. It is accessible from Death Valley and by trail from the Amargosa Desert by way of Lee's camp. There is an abundance of good water. There are springs known as Cow Springs (No. 47) on the western edge of Owens Valley.

35. *Franklin Well, Inyo County* (E-6).—A well was dug in 1852 by a Mr. Franklin near the north edge of Franklin Dry Lake, at the

foot of the south end of the Funeral Mountains, to supply water for surveying parties at work on the boundary line between California and Nevada. The old road from Furnace Creek to Fairbanks Ranch (Ash Meadows) passed this well, which was in existence in 1901, but other wells have been dug recently on the east side of Franklin Lake south of Fairbanks Ranch, so that travelers now rarely have occasion to hunt for the old well. It was originally about 20 feet deep, and its position is marked by the débris of campers.

36. *Rose Springs, Inyo County* (F-2).—These are well-known springs between Haiwee and Owens Lake and about 8 miles west of Coso Peak. The water is of excellent quality.

37. *Arab Spring, Inyo County* (F-2).—Arab Spring is on the east side of the Coso Mountains, about 9 miles southeast of Owens Lake in an air line. It is about 6 miles south of Omes, on the road to Coso, and about 11 miles due west of Darwin. The spring has long been used and is well known and easily found.

38. *Crystal Springs, Inyo County* (F-3).—Springs of excellent water are located about 6 miles north of Coso and 8 miles southwest of Darwin, on the road between the two settlements. The road from Keeler to Junction by way of Omes and Arab Spring also passes them. They have been known and used for more than forty years. There are other Crystal Springs (No. 316) eastward, in Nevada.

39. *Coso, Inyo County* (F-3).—Coso is a mining and agricultural settlement on the southeast side of the Coso Mountains. It is reached from Keeler by way of Omes, Arab Spring, and Crystal Springs, or by way of Omes, Darwin, and Crystal Springs. It is well supplied with water, and supplies for travelers can be obtained there. The water comes from granite and is of characteristic purity.

40. *Willow Springs, Inyo County* (F-3).—These springs are away from the main roads and trails, in Darwin Canyon, about 4 miles northeast of Darwin post-office, at an elevation of 3,600 feet. Their exact location can best be ascertained by inquiring at the post-office. The water is said to be excellent. There are other springs of the same name (No. 87) about 10 miles northwest of Randsburg.

41. *Spring (no name), Inyo County* (F-3).—This spring is in the pass at the north end of the Argus Mountains, on the road from Darwin to Junction. It has long been a camping place and is therefore clearly marked. The water, like that at Coso, comes from granite and is of excellent quality.

42. *Wild Rose Spring, Inyo County* (F-4).—This is a well-known spring and one of the principal stopping places on the road from Ballarat to the Panamint Valley and the north end of Death Valley. It is situated in Wild Rose Canyon, on the west side of the Panamint Range, about 20 miles north of Ballarat. There is also a road to it from Owens Lake, by way of Darwin. The water is excellent and

abundant. The spring has been a camping place for years and is easily found.

43. *Tule Springs, Inyo County (F-5).*—Tule Springs are on the western edge of the sink of Death Valley, about 5 miles north of Bennet's Wells. They are by the side of the only road that traverses the west side of the valley and are marked by small clumps of tules. The yield is small and the springs are usually partially choked with mud. The water is brackish and not so good as that at Bennet's Wells.

44. *Bennet's Wells, Inyo County (F-5).*—These watering places are on the west side of the sink of Death Valley, about halfway between its south end and the mouth of Furnace Creek, at 260 feet below sea level. They lie west of the lowest point in the sink, which is about 276 feet below sea level. A wagon road from the south end of the valley passes the wells, whose position is marked by a growth of tules, by many evidences of former camps, and by the ruins of the works of the Eagle Borax Company, which at one time operated there. The "wells," so called, are springs that were dug out and protected by barrels many years ago, and were used, until about twelve years ago, by the mule teams that hauled borax from the north end of Death Valley.

The Panamint Range is precipitous along its eastern edge, and there is but little room for a road between the foot of the range and the edge of the sink. The whole surface of the sink is covered with heavy saline deposits, which can be crossed at only a few places. The water from the old wells contains much mineral matter, mainly salt and sulphate of soda.

As there are few travelers over this route now, the springs are apt to be choked with drifting sand and must be cleaned out before a supply of water can be obtained. When the springs are cleaned the water can be used by men as well as by animals, but is not very palatable.

45. *Springs, Inyo County (F-6).*—There are a number of springs on the west side of the Black Mountains, near the summit, that give a small amount of water for several months of the year, but are generally dry during the summer. They are called springs by the prospectors, but are not to be depended on for a steady water supply.

46. *Greenwater, Inyo County (F-6).*—This is the business center of the Greenwater district. It is reached by stage or by automobile from Zabriskie, on the Tonopah and Tidewater Railroad, or from Amargosa, on the Las Vegas and Tonopah Railroad. Water is hauled to the district at present, but pipe lines are being put in.

47. *Cow Springs, Inyo County (G-2).*—These are small springs about 5 miles west of Little Lake, and are used by prospectors in that region. They are not on any main road.

48. *Spring (no name), Inyo County (G-3).*—This spring is in a pass at the north end of the Argus Mountains, on the road from Argus by way of Junction to Ballarat. As it has been used for years, it is plainly marked by the débris of camps. A road turns northward here toward Darwin and to Modoc. The water is good.

49. *Confidence Springs, Inyo County (G-6).*—These springs are about 7 miles north of the ruins of the old Confidence gold mill in the Amargosa Range, near what is called the Narrows, in South Death Valley. The old mill is about 20 miles northwest of Saratoga Springs. It was operated by the Mormons more than twenty-five years ago on silver ores taken from a mine in the mountains 7 miles north of the mill. Its situation is marked by the ruins of adobe houses that can be seen for 5 or 6 miles. These houses are on the north side of the valley, by the old wagon road. In 1903 there remained also some old feeding troughs and the wreck of the stables. There is a shaft near the ruins of the stables that is about 100 feet deep, but it contains only a heavy brine.

A trail leads from the mill northward into the mountains for 3 miles and then branches, one branch leading to the right, or east, across to the mines, where there is no water, the other to the left, or west, to the springs. This trail is obscure and the springs are small and not easily found. The water was at one time piped to the old mill and remnants of this pipe aid in finding the trail.

Between the springs and Bennet's Wells, a distance of more than 30 miles to the northwest, there are no other springs known near the road, so that the long trip from Saratoga Springs into the sink of Death Valley by this route is dangerous. (See Coleman Springs, No. 33.)

50. *Hot Springs, Inyo County (G-7).*—There are two hot springs on the eastern edge of Resting Springs Dry Lake, about 3 miles southeast of Zabriskie. These springs yield about 200 gallons per minute of water which contains, according to qualitative determinations, sulphates of soda and magnesia, some borax, and some niter. In the fall of 1908 there was an old tent at the springs, which are occasionally used for bathing purposes. The temperature of the water is about 107° F. They are about one-half mile northeast of the Tonopah and Tidewater Railroad, and a ditch and pipe leads part of the water to a watering tank beside the track.

51. *Resting Springs, Inyo County (G-7).*—Resting Springs, elevation 1,750 feet, are a well-known stopping place for all who travel in the northern part of the desert. Philander Lee has made his home here for thirty years, and his ranch of 200 acres, with shade trees, fruits, garden, and alfalfa fields, is a veritable oasis. These springs, the China ranch, and Coleman are the only places in the Death Valley region where hay can be procured. The ranch and springs are at

the south end of the Resting Springs Mountains. The waters well up from sandstone and are clear and wholesome. The Lee ranch is about 8 miles east of Zabriskie, a station on the Tonopah and Tidewater Railroad.

There are wagon roads to these springs from the east by way of Ivanpah, on the Santa Fe Railway, and thence northward to Sandy; or from Jean, Nev., on the Salt Lake road, westward to Sandy. At Sandy travelers can procure hay, grain, and other supplies. From Sandy the best route is northward by way of Manse where directions may be obtained for going to Resting Springs, about 35 miles to the southwest. There is also a road from Stump Spring directly west to Resting Springs, but it is rocky, and because of the drifting sands is apt to be dim and not easily followed.

There is an old trail from Sandy to Horsethief Spring (No. 79), thence along the north edge of the Kingston Mountains to Tecopa, and on to these springs, but it is unwise to attempt to follow this road without an experienced guide.

From Resting Springs a road runs westward across Resting Springs Dry Lake to the buildings of the old Amargosa Borax Company. There one road turns southward by way of the Ibex mine to Saratoga Springs, and another turns northward to the head of Furnace Creek. Formerly no water was procurable along the latter route between Resting Springs and Coleman, a distance of 50 miles, but conditions have been altered since the Greenwater mining camp was established.

The old San Bernardino and Salt Lake emigrant road passes these springs and goes through Emigrant Pass, just north of the ranch, and thence eastward by way of Stump Spring to Las Vegas. In the days of the old "Spanish trail" these springs were known as the Archillette. J. C. Frémont camped by them April 29, 1844, and named them "Agua de Hernández," for the survivor of a party of emigrants who were murdered there. Frémont rescued Hernández and buried his companions. He described the place as "a grassy spot, with springs and bushes, which make a camping place."

52. *China ranch, Inyo County* (G-7).—China ranch, elevation 1,357 feet, also known as Morrison ranch and Willow Creek ranch, is on the main road from Daggett to Resting Springs. On leaving Cave Springs (No. 73) and passing down the north side of the Avawatz Mountains into the bottom of Death Valley, the road branches, one fork turning to the northwest, to Saratoga Springs (No. 74), and the other continuing a little east of north, across the flat, and to China ranch. This road is frequently obscure, as it is not often traveled and the sand drifts over it. Nearly all travelers go to Saratoga Springs and stay there over night, as the road across Death Valley is very sandy. It is about 30 miles to China ranch from Cave Springs direct, and

about 20 miles by road from Saratoga Springs. To find the ranch from Saratoga Springs one may either travel eastward past the foot of the Black Mountains, and then northeastward through a pass in the lower ridge ahead, passing along the south edge of the sand dunes, or may take the road around the southern end of this lower ridge.

Travel is difficult for $1\frac{1}{2}$ miles through the sand dunes and across the pass, but the route is shorter than that to the south around the ridge. From the east side of the divide the road bears sharply northeastward to the mouth of Amargosa Canyon, which can be seen from a distance. When the mouth of the canyon is reached water can be had from the river. Stock will drink it, but it is strongly alkaline. The road then runs up the canyon for about 9 miles, passing under two trestle bridges of the Tonopah and Tidewater Railroad, 2 or 3 miles north of Sperry station, then crosses the track and turns eastward to the ranch, about 5 miles above Sperry. The road thence keeps a straight course northward up Willow Creek, from which the ranch derives its water supply. The springs that furnish this water rise in Tertiary rocks, which outcrop around the ranch to a height of 500 to 600 feet.

Good hay can be obtained here, the first to be had after leaving Daggett, 110 miles south. Willow Creek furnishes sufficient water to irrigate about 100 acres of land. This ranch is one of the real oases of the desert, and travelers appreciate the cool water, the supply of alfalfa, and the shade of the fig trees.

Resting Springs are about 6 miles northeast of this ranch and Tecopa is about 7 miles east. The old emigrant road from Salt Lake passed here on its way south by way of Soda Lake and Salt Spring (No. 75) to Cajon Pass.

J. C. Frémont passed this spot April 29, 1844, on his way from Tomaso Springs (No. 103) to Resting Springs. He says of it: "The ravine [Amargosa Canyon] opened into a valley [Willow Creek], where there were springs of excellent water."

53. *Tule Spring, Inyo County* (G-7).—This spring is about 3 miles northeast of Tecopa along the roadside on the north slope of the rise near Dry Lake, between Tecopa and Manse. It has been roofed over to protect the water from cattle. The supply is not large, but the water is of fair quality. From 1 to 2 barrels at a time may be dipped from the springs.

54. *Tecopa Well, Inyo County* (G-7).—Tecopa is an old lead-mining camp at the head of Willow Creek, on the north side of the Kingston Mountains. When silver mining was active this was a large camp, with a lead smelter and many adobe houses. In the fall of 1908 mining was resumed and the locality is again a center of activity. The place is supplied with a well which stands by the

roadside about 100 yards east of the old smelter. The water is excellent, and is usually 7 or 8 feet deep.

Tecopa is about 7 miles east of China ranch, on the main road from that place to Manse, Nev. It is easily found by following the road directly up Willow Creek from China ranch to the smelter. There is also a wagon road from Tecopa to Resting Springs, which lie about 5 miles north. It is 7 miles southeast of Tecopa station, on the Tonopah and Tidewater Railroad.

55. *Grapevine Springs, Kern County (H-2).*—These springs are 4 miles north of Indian Wells station, on the road to Owens Lake. They lie near the edge of the road at the foot of the Sierra Nevada. A short distance above the springs in Grapevine Canyon running water is always to be found. The wild grapes which grow in the canyon have given it its name. The water is of excellent quality and the supply is ample for camping parties. There are other springs known by the same name near the Staininger ranch, in the Grapevine Mountains.

56. *Freeman post-office, Kern County (H-2).*—Freeman post-office, elevation about 3,370 feet, is a well-known camping place at the point where the old emigrant road from Bakersfield, by way of Walkers Pass, reaches the desert. Here there are a number of buildings, including a post-office and a small supply store. Meals and accommodations for the night may also be obtained here. There is a fair supply of water. Roads lead from this point in several directions. One passes southward by way of Redrock Canyon to Mohave, and one by way of Haggin Well (No. 86) and Willow Springs (No. 87) to Randsburg, while another runs eastward to Searles.

57. *China Well, San Bernardino County (H-3).*—An old well was dug at the Chinese camp north of China Dry Lake when the borax deposits were worked in 1890–91. There is a road leading to it by way of Lander Well (No. 58) from Gardners station (Searles post-office). At it the roads branch, one branch leading westward to Indian Wells and Little Lake, and the other northward to Argus. The well is not kept cleaned and the water is of only fair quality.

58. *Lander Well, Kern County (H-3).*—This is an old well on the road from Randsburg by way of Searles post-office (Gardners station) to China Lake, thence northward to Argus and other points in Inyo County. The well is about 6 miles northwest of Searles, near a vacant house. The water is slightly alkaline, but of fair quality. The next water toward the north is found at China Well, 14 miles away.

59. *Searles Springs, Kern County (H-3).*—These springs are about 5 miles southwest of Searles post-office. They supply that stage station with water.

60. *Searles post-office, San Bernardino County* (H-3).—Searles post-office, locally known as Gardners station, is a well-known stage station 18 miles north of Johannesburg, on the road to Ballarat. Water is piped to it from springs about 5 miles southwest, and is sold to travelers. The water is of excellent quality, but the supply is meager. In addition to the post-office and stage station there are, at this point, a store, a telephone station, and a corral.

61. *Salt Well, San Bernardino County* (H-3).—This is a well sunk by the stage company on the road from Johannesburg to Ballarat at an elevation of 2,200 feet. On reaching the divide north of Searles post-office the traveler will see, at the foot of the grade, a dry lake covered with a white crust of borax. The well is about half a mile south of this lake, on the west side of the road. Its position is indicated by a new adobe building and by the ruins of an old adobe building and a stamp mill. The water is brackish but drinkable, and the well is supplied with a good iron pump. In Death Valley there is another "salt well," No. 31, in which the water is stronger than at this one near Searles.

62. *Quail Springs, San Bernardino County* (H-3).—These small springs are in the broken country about 8 miles east of Searles post-office. They are distant from all roads and trails and are used only by prospectors who are thoroughly familiar with the region. Other unimportant springs of the same name (No. 67) lie in the Quail Mountains, about 35 miles to the east; while at the north base of San Bernardino Mountains there is a third group of the same name (No. 210).

63. *Borax works at Searles Lake, San Bernardino County* (H-4).—Water can be obtained at the stage station at the old borax works on Searles Borax Lake, on the stage road from Randsburg to Ballarat. Water is piped to the station from springs several miles away, in the Argus Range.

64. *Slate Range gold mine, San Bernardino County* (H-4).—This mine is on the west side of the Slate Mountains and on the east side of Searles Borax Lake. Where the stage road from Johannesburg to Ballarat reaches the southwest corner of Searles Lake a well-traveled road turns eastward across the lake. This road is cut deep into the borax crusts and leads directly to the mine, whose buildings can be seen from a distance of several miles. The mining company has a number of wells that supply the camp and mill, and the miners at the camp can direct travelers to other springs in the mountains farther north.

Near the east side of the dry lake a dim road turns southward up a canyon at the foot of the range. It branches southward to Granite Wells (No. 96) and eastward to Leach's Spring (No. 69).

65. *Lone Willow Spring, San Bernardino County* (H-4).—This spring has long been known to desert travelers, as it is the first watering place north of Granite Wells (No. 96) on the road to Panamint Valley. It is about 25 miles north and a little east of Granite Wells. The spring is in a canyon in the pass between the Slate Range and Brown Mountain. It was at one time one of the stations for the "20-mule teams" hauling borax from Death Valley to Mohave, and the site of the station is indicated by old troughs and by the pipe that carries the water, whose quality is excellent, from the springs to the road. The spring was named from a lone willow that once stood near it. A short distance north of it the road branches, the eastern branch leading to the sink of Death Valley. There is no water on this road for about 38 miles, until Bennet's Wells are reached, but water may be obtained at mining camps at several points on the northern road, which leads to Ballarat.

66. *Hidden Springs, San Bernardino County* (H-5).—These springs are near the crest of the Quail Mountains, a range about 12 miles long, lying east of Brown Mountain and north of Leach Mountain. The springs are on trails known only to prospectors. They are found by following the trails of wild burros that go to them to drink.

67. *Quail Springs, San Bernardino County* (H-5).—These small springs are also in the Quail Mountains, almost due north of Leach's Spring (No. 69). They are high up in the range, away from all roads and trails, and are visited only by prospectors. The water is cold and good. They should not be confused with No. 62, which is another group of small springs of the same name, about 35 miles to the west.

68. *Fourth of July Springs, San Bernardino County* (H-5).—These form the third group of springs reported to exist in Quail Mountains. They are on the north side of the range, about 7 miles north of Leach's Spring. There is no road and no well-defined trail to them, but it is said that prospectors are able to get water for themselves and their pack animals here.

69. *Leach's Spring, San Bernardino County* (H-5).—Leach's Spring (elevation about 3,534 feet) is one of the most important camping places on the road from Randsburg to South Death Valley and to points in Nevada by way of Saratoga Springs to Resting Springs, and its water is the best to be found between Saratoga Springs and Granite Wells. Travelers are advised to make a dry camp for one night between Granite Wells and Leach's Spring. In approaching the spring from the west one ascends a steep grade through deep sand, where teams often have to double for 3 miles or more. When the summit of this grade is reached a plain road is seen leading to the right—that is, to the south—into the mountains. This road ascends steeply nearly to the main summit. At the foot of the granite pinnacles that form the axis of the range there are a few acres covered with camp

débris. Directly south of the camp is a granite boulder over 60 feet high, which bears a striking resemblance to an elephant's head, trunk, and forefeet, stationed as if the animal were looking directly north. The locality may be further identified by the Indian arrowheads of flint and obsidian that strew the ground. The spring is in a little canyon to the west, perhaps 60 feet lower than the camping place and about 100 yards from it. Its position was once marked by a lone cottonwood tree, but this has been cut down. Four or five barrels may easily be filled in one night from this spring, and other springs are to be found for a distance of about 500 feet up the canyon. Water was once piped from the spring down to the main road for the use of the borax teams from Death Valley, and there are ruins of two corrals along this old pipe line, but there is no water near them.

On leaving the spring eastbound toward Death Valley, the traveler should follow the road down a dry wash to a dry lake, where he should turn northward along the west side of the lake, until he reaches a low divide. Owl Springs (No. 70) lie about 2 miles north of this divide. On approaching Owl Springs from the south he should keep to the main road. Several persons have been lost by turning eastward at the summit, on a road that is less plain than the one that leads to the springs.

70. *Owl Springs, San Bernardino County (H-6).*—Owl Springs are about 2 miles north of the pass between the Owl Mountains and the Avawatz Mountains. They are about 17 miles by road from Leach's Spring and about 18 miles southwest of Saratoga Springs (No. 74), and furnish the only water to be obtained between these two places. On leaving Leach's Spring the road passes along the west edge of a dry lake, beyond which it climbs a low divide at the west end of the Avawatz Range. On reaching the summit the road starts down the main wash to the north, and follows it nearly to the springs, turning to the left, or west, at the foot of the Owl Mountains proper. The springs are easily found, as they are at the foot of a monument of stones about 3 feet high, placed to mark the corners of mineral claims, and the area round about them is littered by the débris of many camps. The springs are about 6 feet deep, and the water is not too saline for comfort. A short distance to the west is a trench about 25 feet long and 10 feet deep at the deeper end. The water from this trench is in larger amount and of better quality than that of the original springs. Water can be had almost anywhere around this point, for a distance of at least 300 feet north and south, by digging shallow wells.

The road northeastward to Saratoga Springs is sometimes obscured by washouts. Death Valley is in plain sight, however, and if, after following the wash for about 10 miles, the traveler can not find the road, he should keep to the right-hand side of it until he finds a

road running directly east. This road crosses a low spur of the mountains and is the best route to Saratoga Springs. The traveler may keep on down the wash to the main valley, but will find very heavy sand and rough driving, and may be compelled to return to the southeast along the foot of the Avawatz Range until he finds the right road. In attempting to cross the Amargosa River directly below this road the traveler is in danger of getting into soft and treacherous ground.

71. *Brook Spring, San Bernardino County (H-6).*—There is a small spring at the north end of the pass between the Avawatz Mountains and Leach Mountain, to which there is no road. A wagon can be driven to it from the Leach Spring and Owl Springs road by turning off at the dry lake and going southeastward up the wash. The spring is plainly marked by the litter of prospectors' camps.

72. *Valley Springs (South Death Valley), San Bernardino County (H-6).*—Strong springs boil up in a marsh about 8 miles northwest of Saratoga Springs. Their waters are so salt as to be unfit for use. As the springs form a clear, sparkling stream for a short distance before the waters sink again, travelers are inclined to let their stock drink from them. These springs can be seen from the road that leads from Death Valley toward the sink. The ground about them appears to be firm, and in most places will support a light wagon, but it is really only a crust underlain by a deep ooze in which both men and teams may sink. There is nothing in the appearance of the ground about these dangerous spots to give warning of their nature, hence the only safe rule, when traveling in the valley away from the main trails, is to test carefully all moist areas and all ground near springs with some sort of sounding rod before walking or driving upon it.

The springs are probably nothing more than a part of Amargosa River coming to the surface, as a rock reef extends across the valley half a mile below them. The volume of water supports this view.

An analysis of the water made by Thomas Price, of San Francisco, gives the following results:

Analysis of water from Valley Springs.^a

Sodium (Na)-----	29, 313
Potassium (K)-----	1, 198
Chlorine (Cl)-----	20, 182
Carbonate radicle (CO ₃)-----	16, 690
Sulphate radicle (SO ₄)-----	7, 532
Hydrogen sulphide (H ₂ S)-----	346
Silica -----	240
Organic matter-----	223

^a Expressed by analyst in grains per gallon and hypothetical combinations; recomputed to parts per million and ionic form at U. S. Geol. Survey.

73. *Cave Springs, San Bernardino County* (H-6).—Cave Springs (elevation about 6,290 feet) are a well-known stopping place on the road from Daggett to Death Valley, and the water here is the last to be had before going down into the valley. The springs are near the summit of the Avawatz Mountains, and, as their name indicates, they are found in large grottos or caves. As all travelers stop here, the majority of them camping over night, the place is clearly marked by camp litter. There are two springs, each about 5 feet across and each containing about 5 feet of water. They have been cleaned out and boarded up, but are not provided with a pump. The water is excellent.

It is about 12 miles by road north from Cave Springs to Saratoga Springs in Death Valley and about 30 miles south to Garlic Spring (No. 135).

74. *Saratoga Springs, San Bernardino County* (H7).—Saratoga Springs (elevation 362 feet), situated about 20 miles west of Dumont, on the Tonopah and Tidewater Railroad, are well known to every traveler to Death Valley, as their site is the principal camping point each winter for prospectors who have claims in the vicinity. They are at the southwest edge of a black point of the Black Mountains that projects southward into the valley. The slope of the mountains east of this point is covered with sand and recedes to the north in a large cove, but part of the range that lies immediately back (northeast) of the springs is rugged and rocky. The springs can not easily be distinguished at a distance, for their location is marked mainly by the tules growing around them, and by prospectors' stone houses, which are nearly of the color of the surrounding rocks, and on approaching from the south they are hidden by a point of rocks until one is within a few yards of them.

The springs proper form a pool about 25 feet in diameter and 4 feet deep. The bottom is of white sand, which is kept in constant motion by the rising water. The overflow from the pool forms a little stream that runs northward into shallow lakes, covering 10 or 15 acres, and surrounded by tules. One might travel along the road leading from the springs northwestward to the Old Ibex mine without suspecting the existence of these lakes, as they are concealed by ridges of sand. In winter many ducks and geese may be found here, a fact appreciated by prospectors.

Even in the coldest weather the water of Saratoga Springs has a temperature of 80° or 85°; hence the springs make a bathing pool that is delightfully refreshing after long days of weary travel over the desert. It is worthy of note that the water is full of small fish, up to about 2½ inches long, of a grayish-black color. Similar fish are found at Pahrump and in other desert springs.

The road from Daggett by way of Cave Springs enters Death Valley about 5 miles southeast of Saratoga. The road from Johannesburg comes in from the west, crossing the west end of the niter beds that lie along the north flank of the Avawatz Mountains. The road to Resting Springs leads from Saratoga southeastward toward Cave Springs for about 1 mile, then turns eastward past a little lava knob in the bottom of the valley and continues in this direction toward a long spur of the Black Mountains that juts into the valley. The traveler may cross the south end of the sand dunes and climb the short grade through the low sandy pass just east of the dunes, or he may go around this spur to the south. It is a steep and hard pull through the sand to the top of the pass, but beyond the top the trail northeastward across the flat to Amargosa River is firm and no rougher than the rest of the valley. The right-hand road has no grades, as it passes around the southern end of the ridge. It crosses the Amargosa River where the latter passes close between the point of the ridge and a black butte that lies as a southeastern extension of the ridge. Thence the road swings northeastward and joins the other branch. When Amargosa River is reached it should be followed up to the canyon, where the roads are plainly marked, and thence past Sperry to the China ranch. Another road leads from Saratoga Springs northward to the summit of the Black Mountains, passing the Ibex mine, and then turning east to Resting Springs; but this road has steep grades, is very rocky in places, and in other places is covered with deep sand. The road up Amargosa Canyon is to be preferred. There is also a dim trail along the south flank of the Black Mountains, leading to the sink of Death Valley, but no water is to be had on it, except at Confidence Springs (No. 49), until one reaches Bennet's Wells, a distance of about 50 miles.

75. *Salt Spring, San Bernardino County* (H-7).—This spring of nonpotable water is in the canyon of the south branch of Amargosa River, at the east end of South Death Valley, at an elevation of 300 feet, 5 miles southwest of Dumont, on the Tonopah and Tidewater Railroad. This canyon is the pass between the Kingston and Avawatz mountains, about 14 miles southeast of Saratoga Springs. On the south side of a spur of the Kingston Mountains are the ruins of the camp of the old Amargosa gold mine, in plain view of travelers approaching from the south.

At the old mine there is a little canyon that descends sharply to the north, in which there are the ruins of a 20-stamp mill. Near the mill are two wells, protected by curbing and covered, from which water of fairly good quality may be had. This is an important thing to know, for the waters of Salt Spring are unsafe and several persons have perished from drinking them. They are supposed by miners to contain arsenic. An analysis shows, however, that al-

though they contain no arsenic they do contain very large amounts of sodium and magnesium sulphates, being in fact an almost saturated solution of Glauber and Epsom salts. Men delirious from thirst, whose sense of taste is nearly lost, may easily drink so heartily of these waters as to produce fatal results. Several other springs on the desert that are reputed to contain arsenic are similar in character.

The road from Salt Spring northward to the canyon of the Amargosa and to China ranch is covered with deep sand, very difficult to cross. The only water to be had along it is that of the Amargosa River, when it flows this far south, or at Sperry railroad station, until the ranch is reached, a drive of 16 miles. The road running westward to Saratoga Springs is rough, but the writer has always preferred to go there for a night camp, returning thence to China ranch rather than to cross the heavy sands north of Salt Spring.

J. C. Frémont camped there April 28, 1844, and speaks of the place as follows: "A very poor camping place—a swampy, salty spot, with a very little unwholesome grass. The water rose in the springs entirely too salt to drink." He says also that they found "a spring of good water a few hundred yards away in the hill." This good spring is north of Salt Spring.

76. *Sweetwater Springs, San Bernardino County* (H-7).—These springs are about 9 miles northwest of Williams Well (No. 105), at the east end of the Avawatz Mountains. They are not on a main line of travel, but are used by prospectors in the Avawatz Mountains, who are said to have recently so marked their location that they can be found by others.

77. *Kingston Springs, San Bernardino County* (H-8).—These are small springs at the north end of the Shadow Mountains, about 2 miles south of Coyote Holes (No. 78). They are not on any road and there is no well-defined trail to them. The amount of water available is small, but its quality is good.

78. *Coyote Holes, San Bernardino County* (H-8).—These are brackish springs at the north end of the Shadow Mountains near the head of the divide between these mountains and the Kingston Mountains, on the road from Death Valley to Ivanpah, by way of Clark Mountain, and on the road from Daggett to Sandy, Nev., by way of Bitter Spring (No. 136). The nearest water to the southwest is at the Riggs mine (No. 106), in Silurian Mountain, about 20 miles distant. Horsethief Spring (No. 79) is west of the road at the north end of the pass through the Kingston Mountains. There are also springs (No. 77) about 2 miles south, near the north end of the Shadow Mountains, but they are difficult to find. There is still another spring about 7 miles to the southeast, which may be reached by a dim road along the north side of the Shadow Mountains. Another watering

place of the same name, now seldom used (No. 209), lies far to the south at the east base of the San Bernardino Mountains.

79. *Horsethief Spring, San Bernardino County* (H-8).—This spring, elevation 5,600 feet, is located in the pass between the Kingston Mountains and Clark Mountain, on the road that runs from the Williams Well (No. 105) past Coyote Holes. At Coyote Holes the roads branch, one branch leading northeastward by way of Horsethief Spring to points in Nevada, the other going south of Clark Mountain to the town of Ivanpah. The road that passes this spring is very stony and rarely traveled, but the position of the spring is clearly indicated by camp litter. The spring is in shale and the water is of good quality.

80. *Cunningham Spring, San Bernardino County* (H-8).—This is a small spring on the northeast border of the Shadow Mountains, about 6 miles southeast of Coyote Holes, on the road from the latter, by way of Clark Mountain, to Ivanpah. The water is good and the location is marked by the evidences of old camps.

81. *Pachanca Springs, San Bernardino County* (H-9).—These are small springs along the northwest base of Clark Mountain. They are away from all main roads and are used only by prospectors in that range. They are not easily found without a guide.

82. *Ricardo, Kern County* (I-1).—Ricardo is the Spanish name of a ranch in Redrock Canyon on the road from Mohave to Owens Lake, where travelers sometimes stop for water.

84. *Kane Springs, Kern County* (I-2).—Kane Springs are on the west side of Kane Dry Lake and appear on some maps as the Keehn Well. The locality is a station on the stage road from Mohave to Randsburg, by way of Water station, which is about 15 miles southwest. Garlock station is about 9 miles northeast. The water of Kane Springs is slightly brackish. Kane's Wells lie south of east from these springs on a road between Barstow and Coolgardie.

85. *Garlock, Kern County* (I-2).—Garlock post-office is at the south end of the El Paso Range on the stage road from Mohave to Randsburg, by way of Water station and Kane Lake. It is a general supply point for travelers and prospectors. From this point the road begins to ascend heavy grades to Randsburg, 12 miles distant. It is therefore a favorite camping place for those with heavy loads. The water is abundant, and supplies can be obtained at the ranch. Kane Springs and Kane Dry Lake are about 9 miles southwest.

86. *Haggin Well, Kern County* (I-2).—The Haggin ranch is on the wagon road from Randsburg northwest to Freeman, about 10 miles northwest of Johannesburg, 15 miles southeast of Freeman, and 1 mile northwest of Willow Springs (No. 87), at an elevation of about 3,350 feet (U. S. Geological Survey). On this ranch there is a well that supplies good water.

87. *Willow Springs, Kern County (I-2).*—These springs are at the east end of the El Paso Mountains, about 1 mile southeast of Haggin Well and about 10 miles northwest from Randsburg, on the road to Freeman, at an elevation of about 3,850 feet (U. S. Geological Survey). On account of their proximity to the Haggin ranch, the usual stopping place for travelers in this vicinity, the springs are unimportant except to local prospectors.

88. *Summit Diggings, San Bernardino County (I-3).*—This is a small placer camp about 6 miles north of Johannesburg, on the stage road to the Panamint Valley. The camp is well supplied with water by local springs.

89. *Skilling Wells, San Bernardino County (I-3).*—This is a group of privately owned wells about 4 miles northeast of Johannesburg, near the City Wells. The water is used to supply Johannesburg and Randsburg.

90. *City Wells, San Bernardino County (I-3).*—This is a group of drilled wells on the southwest flank of Klinker Mountain, about 5 miles northeast of Johannesburg, at an elevation of 3,400 feet. Some of the wells are supplied with windmills, others have steam pumps, and the water forms the principal part of the supply for Johannesburg and Randsburg. The house and windmills make a prominent landmark, which can be seen for 3 or 4 miles. A telephone line connects the city and the wells. The stage road from Johannesburg north to Ballarat passes nearly 3 miles west of the wells. The road from Johannesburg to Pilot Peak approaches within half a mile of them, then turns down a canyon to the southeast toward Willard Dry Lake. (See Blackwater Well, No. 95.)

91. *Squaw Spring, San Bernardino County (I-3).*—This spring is about 4 miles due east of Johannesburg, at an elevation of 3,475 feet, and is most easily reached by going from Johannesburg eastward to the City Wells, then southeastward on the Pilot Peak road to the head of the canyon just below the City Wells. There a plain road skirting the side of the mountain to the south leads to the Squaw Spring. It is not on a main line of travel and is used only by local prospectors. The water is good.

92. *Blackhawk Well, San Bernardino County (I-3).*—Blackhawk Well, elevation 2,665 feet (U. S. Geological Survey), lies at the south end of Red Mountain, about $6\frac{1}{2}$ miles northeast of St. Elmo and about 11 miles by road southeast of Johannesburg. After leaving Johannesburg, on the Pilot Peak road, a road that leads to Blackhawk Well turns to the south beyond the City Wells. The well is not in general use by travelers, because it is not on a main road, but it is occasionally used by those who go from Johannesburg to Barstow by way of Fremont's Peak and the Black Range. The water is excellent, and miners haul it to their camps.

93. *Bedrock Spring, San Bernardino County (I-3).*—This small but excellent spring is on the north side of Klinker Mountain on the old wagon road from Johannesburg through Bedrock Canyon to Searles Lake, about 10 miles northeast of Johannesburg, at an elevation of 3,225 feet (U. S. Geological Survey). This road is rarely used except by freighters who are well acquainted with the country, because no water can be obtained along it for a stretch of 30 miles or more. Travelers are advised to follow the main road by way of Searles post-office.

94. *Well at Willard Lake, San Bernardino County (I-3).*—This is a well that was dug years ago at the northeast end of Willard Dry Lake, alongside the old Death Valley borax road, at an elevation of about 2,520 feet. It gave a good supply of slightly brackish water. The well is now partially caved in and should be cleaned out. It is not on any of the main lines of travel, but is some distance south of the road from Johannesburg to Blackwater well.

95. *Blackwater Well, San Bernardino County (I-4).*—This well is one of the important camping and watering places on the main road from Johannesburg to Death Valley and Resting Springs. It is on a divide about 18 miles east of Johannesburg. The road eastward from the town runs past the railroad roundhouse toward the City Wells, which can be seen toward the northeast. About 2 miles from Johannesburg it forks; the left branch, bearing to the north, goes to Ballarat via Searles Lake; the right-hand branch runs directly toward the City Wells, and when nearly south of them turns down the canyon to the southeast. At the foot of the hill this road runs eastward to the base of Lava Mountain and north of Willard Dry Lake. In the distance a low ridge is seen, lying at right angles to the road—that is, in a north-south direction. Blackwater Well lies nearly at the crest of this ridge. The main road crosses several of the old Death Valley borax-works roads, which come in from the south in the direction of the dry lake, and these roads must be avoided, as there is no water on them for 25 miles in either direction. When the summit is reached the well can be located by the bare ground in its neighborhood, from which campers have stripped all vegetation. The well, which was dug years ago by government troops, is about 15 feet deep and is in the form of a shaft, 5 by 7 feet. The water in it is usually from 2 to 3 feet deep. When the well has not been used for a long time the water becomes dark colored and ill smelling and is often foul from the bodies of desert rats and rabbits, but when freshly cleaned it is sweet and wholesome and free from alkali. It is probable that if the well were deepened a much more abundant supply would be procured. Water was at one time piped down the slope for a distance of one-half mile to the old Death Valley borax-works road. The remnants of the trenches and pipes aid in locating the well.

A road that turns off at the wells crosses the divide to the east and extends to Copper City, a small mining camp. The road to Death Valley starts northward from the well, reaching the summit in about one-half mile, and the north end of a black lava ridge in about 3 miles. There it turns east directly toward Pilot Peak. From the foot of the lava point it is a heavy climb for 6 miles up the mountain to the base of Pilot Peak, where Granite Wells are located.

96. *Granite Wells, San Bernardino County (I-4).*—One of the best-known camping and watering places on the road to Panamint and Death Valley is at Granite Wells, just west of Pilot Peak, a very prominent landmark in the Mohave Desert. At the base of the peak is a knob of gray granite, north of which are a frame house and the remnants of several stone structures. The best water is found in a short tunnel run into the granite 50 feet northeast of the cabin. At the end of this tunnel is a sump hole, about 3 feet deep, in which the water collects. This water, coming from the granite, is cool and pure, but the sump often needs cleaning out. About 2 barrels can be got here in twenty-four hours. A quarter of a mile down the hill southeast of the granite knob are an old well and an open earth cut that was made to develop water. This cut is just east of the well and may be clogged with sand, but it can be cleaned out in a few hours, and several barrels of water sufficiently good for stock will collect during the night.

From the wells the road passes northward over a low divide and then down to the foot of the Slate Range, meanwhile keeping just west of a long ridge formed by a flow of lava. At the north end of this ridge, which is known as Black Point, the road turns eastward to Slate Range Dry Lake. There the Panamint road branches northward to Lone Willow Spring, while the road to Nevada and South Death Valley runs eastward to Leach's Spring.

There are many dim roads that turn off westward toward the Slate Range and Searles Lake, but no water is to be found along them and they are not plainly marked, whereas the main roads described are well marked.

On the road to Ballarat and the Panamint Valley there is no water to be had until Lone Willow Spring is reached, high up in the pass between the Slate Mountains and Brown Mountain, a distance of nearly 30 miles over a road that is both sandy and rocky.

The road to Death Valley by Leach's Spring is good up to a point within 6 miles of the spring, but this last 6 miles is all upgrade through exceptionally deep sand. Therefore one should travel as far as possible from Granite Wells, make a dry camp, and pull up the grade to the spring early in the morning.

97. *Pilot Spring, San Bernardino County (I-4).*—This spring is between 3 and 4 miles southeast of Granite Wells, near the top of the

hill on the old road to Copper City. The water supply is small and the spring is often choked up, because it is rarely used.

98. *Lead Spring, San Bernardino County* (I-4).—This is a small spring discovered by prospectors who found outcrops of lead ore near it. It is about 4 miles southeast of Black Point, a dark lava knob at the north end of the Pilot Peak Range, where the road from Granite Wells to Leach's Spring turns to the east. In 1904 there was at this point a guideboard that gave directions for finding the spring.

99. *Wheeler Spring, San Bernardino County* (I-6).—This spring is at the south end of Leach Mountain, in the pass between this mountain and the Avawatz Mountains. Brook Spring is 3 miles to the north and Whitney Spring (No. 100) is 5 miles to the southeast. None of these springs is on a main road. They are used only by prospectors and can be located only by the débris of former camps near the dim trail that runs through this pass.

100. *Whitney Spring, San Bernardino County* (I-6).—This spring lies about 5 miles southeast of the pass between Leach Mountain and the Avawatz Range. It is on the north side of Granite Mountains near their base, and the water rises from the granite. The supply is not large but the quality is excellent. Wheeler Spring is about 5 miles northwest and Cave Springs are about 12 miles northeast. There are no good roads or trails to this spring, but it may be found by following the dim trail that leads through the pass at the east end of Leach Mountain.

101. *Government well at Tiefort Mountain, San Bernardino County* (I-6).—It is said that there is still in existence an old well dug by government troops years ago, near the northeast edge of "No. 4 Dry Lake," about 9 miles north of Langford Well (No. 134) and about 5 miles northeast of Garlic Spring (No. 135). This old well is on the road from Daggett to Death Valley, at the southwest end of Tiefort Mountain, and is the only watering place the traveler finds along this road until he reaches Cave Springs, a distance of about 25 miles. The well is reported by recent travelers to have been partly filled by wash carried over it during cloud-bursts, so that water can not be obtained without practically redigging it.

102. *Harper's camps, San Bernardino County* (I-7).—These mining camps are in the south end of the Avawatz Range. A well-traveled road leads to them, branching off the Silver Lake road to Crackerjack, where it crosses the old Mormon trail. This point is about 7 miles northwest of Silver Lake, and is marked by a plain signboard. The road runs northwestward up the flank of the mountain to the largest canyon, and follows up this canyon to the north.

About 4 miles up the canyon the road forks again, the point being marked by a sign reading "Harper's south camp 1 mile" and "Har-

per's north camp 4 miles." Arrows on the signboard indicate the roads.

At the south camp water has been developed by tunneling into the granite. The supply is about 4 miner's inches and is excellent in quality. The north camp is in Arrastre Gulch, where there is a large supply bubbling up from beneath limestones. Arrastre Gulch is the main canyon opening onto the desert at the east end, almost due west of the siding at Riggs, on the Tonopah and Tidewater Railroad.

103. *Tomaso Springs, San Bernardino County* (I-7).—This group of springs lies at the northwest end of the Soda Lake Mountains, about 10 miles northeast of Bitter Spring (No. 136), on the old emigrant road to Salt Lake. Their permanency is indicated by the fact that J. C. Frémont mentions them in his journal. He camped here on his homeward journey from California April 25, 1844, and reported that he found the springs "dug out by the Indians or travelers" and "the waters cool and refreshing." The site of the springs is well marked by camp débris, and the water is good.

104. *Silver Lake, San Bernardino County* (I-8).—This town, on the Tonopah and Tidewater Railroad, is 40 or 50 miles north of Ludlow, on the Santa Fe Railway. It is the supply point for the Crackerjack, Chisholm, Harper, and other mining districts to the east and west. Stages and automobiles run to Crackerjack. Silver Lake has post-office, express, and telegraph offices. The railroad company pumps water from a well about 200 feet deep and pipes it through the town. The water is slightly brackish, but is used freely by everyone. The lake from which the town takes its name is about one-fourth of a mile to the west. It is a shallow, intermittent body of water, formed in a bowl in the desert by the overflow of Mohave River during seasons of unusually high water. Shallow wells sunk near the edge of this lake give an abundant supply of brackish water.

105. *Williams Well, San Bernardino County* (I-8).—There is a well at the edge of Silurian Dry Lake, west of the Riggs mine and well, on the road that leads from Daggett and Soda Lake northward to Death Valley and northeastward to points in Nevada by way of the Kingston Mountains. From this point it is about 25 miles by road southward to Government Well, at Soda Lake (No. 139), and about 20 miles southwestward to Tomaso Springs. Miners here and at Riggs can give information about trails and conditions of water supply farther north.

106. *Riggs Well, San Bernardino County* (I-8).—There is an excellent well at the Riggs gold mine, 2 miles east of Riggs station, on the Tonopah and Tidewater Railroad, and near the east end of Silurian Mountain, a small range lying between the Avawatz and the Shadow mountains. The mine has been in operation for some time

and the camp is a stopping place for all travelers. The road to this camp from Daggett, instead of going by way of Coyote Lake, crosses the east end of Alvord Mountain and goes on by way of Bitter Spring to the east end of the Avawatz Mountains, where it joins the road from Balch on the Salt Lake route. The latter road runs northward from Balch, past Government Well at Soda Lake.

107. *Toltec, San Bernardino County* (I-8).—This is a camp occupied by some turquoise miners. It is at the south end of Shadow Mountains, and about 6 miles northeast of Halloran Springs. The camp is supplied with good water, which comes from springs in the mountains near by.

108. *Halloran Springs, San Bernardino County* (I-8).—Halloran Springs have been for years a camping place for travelers en route from Soda Lake to Ivanpah Mountain and Clark Mountain over the old Ivanpah trail. The springs are near the north end of a little unnamed butte that lies about 10 miles northeast of Dante Springs (No. 140), and are readily located by the quantities of camp rubbish in the vicinity.

109. *Spring, San Bernardino County* (I-8).—Several desert prospectors have reported that there is a spring about 8 miles southeast of Halloran Springs, and that the water is good, but there are no traveled roads or trails to it.

110. *Crater Spring, San Bernardino County* (I-9).—There are said to be springs at the Three Ash Craters, a prominent group of extinct volcanoes in the desert at this point. They are not near the main-traveled roads and are visited only by prospectors. No accurate description of them has been obtained.

111. *Valley Wells, San Bernardino County* (I-9).—Valley Wells, known also as Rosalie Wells, are situated near the border of Ivanpah Mountain, on the main road from Soda Lake and from Kessler Springs (No. 112) to the old copper mine in Ivanpah Mountain. The wells were dug by a mining company and supplied enough water to operate the smelters that were once in use on the copper ores of this district.

112. *Kessler Springs, San Bernardino County* (I-9).—Kessler Springs, elevation 5,500 feet, are well known to most desert travelers, as they are on the old road from Daggett by way of Soda Lake to the New York Mountains. They are at the south end of Ivanpah Mountain, about 6 miles northwest of Cima station, on the Salt Lake Railroad. A road leads from them to the town of Ivanpah, about 10 miles northeast, and to Rosalie, about 12 miles northwest. The water is abundant and excellent.

113. *Cottonwood Spring, San Bernardino County* (I-10).—This spring is on the north side of the New York Mountains, near the Salt Lake Railroad, and is used principally by miners and pros-

pectors in this region, as it is not on any main line of desert travel. There are several springs of this name in the area discussed, so that the name alone is not distinctive. About 30 miles to the southwest are Cottonwood Springs (No. 162), which are also used as a watering place.

115. *Ivanpah Well, San Bernardino County (I-10).*—A well has been dug in the bottom of the south end of Ivanpah Dry Lake, about a mile east of the town of Ivanpah, at an elevation of 4,230 feet (Santa Fe Railway). The town is the present terminus of the Santa Fe branch road from Goffs. This well formerly supplied a stage station on the old road from Barnwell, Cal., to Manse, Nev. It is about 140 feet deep and is provided with a windlass for drawing water. The water is only slightly saline. It is still used by those who drive north from Barnwell.

116. *Saccatone Springs, San Bernardino County (I-10).*—These are small springs on the north side of the New York Mountains and are of importance only to local prospectors and miners, as this region is so thickly settled now as to offer no difficulties to the traveler.

117. *Water Station, Kern County (J-1).*—This is a well-known road ranch and old stage station, about 9 miles northeast of Mohave, on the road from Mohave to Keeler. Good ranch houses, an abundance of water, and accommodations for travelers will be found at the station.

Frémont stopped at the springs here early in April, 1844, on his way from Cameron Salt Lake east by way of the "Desert Buttes" to Mohave River.

118. *Desert Wells, Kern County (J-2).*—This is an old stage station on the Mohave and Randsburg stage road about 6 miles northeast of Water station, and 15 miles from Mohave, the junction of the Southern Pacific and Santa Fe railroads. A road runs eastward from these wells to Francis Well (No. 119), on the railroad from Kramer to Randsburg.

119. *Francis Well, San Bernardino County (J-3).*—This is a drilled well, equipped with a pumping plant, on the railroad between Kramer and Johannesburg, about 12 miles north of Kramer, at an elevation of 4,220 feet (Santa Fe Railway). It is a watering place for travelers from Mohave by way of Desert Wells and for those going by team from Kramer to the mines farther north.

120. *Goleta Spring, San Bernardino County (J-3).*—At the southeast base of Fremont Peak there is a spring whose name dates back to the time of Frémont's last homeward trip across the Mohave Desert. It is just west of the old road that runs from Randsburg to Barstow by way of Harper Dry Lake and Black ranch (No. 123). Another old road branches from this main road about 3 miles west of Harper Lake and runs southward to Harper station, on the Santa Fe

Railway. There has been very little travel over any of these roads for a number of years.

121. *Star Springs, San Bernardino County (J-4).*—These springs are about 3 miles east of the south end of Fremont Peak, on the east side of the pass through which the road from St. Elmo to Harper runs. They are along the west base of the Black Range. As there is good water at Goleta Spring, on the wagon road directly west, the Star Springs are not important to travelers.

122. *Grant Springs, San Bernardino County (J-4).*—There are reported to be good springs at the Grant Corral, $1\frac{1}{2}$ miles northwest of the Black ranch, on the old San Bernardino and Panamint road, at the point where it passes Harper Lake. The springs are between Harper Lake and the low range of mountains to the north. As there is a good supply of water at Black's Well (No. 123), these springs are not important.

123. *Black's Well, San Bernardino County (J-4).*—This well is about 7 miles northwest of Hinkley, at the east end of Harper Lake, on the old road from Victorville and Hinkley stations to Death Valley formerly known as the San Bernardino and Panamint road. An adobe house, which served as the headquarters of an old cattle ranch, is still standing near the well and is in good condition. The well is covered with a platform and the water stands within a few feet of the top. It is dark colored, but nearly free from saline matter.

The cottonwood trees that surround the well and house can be seen from a distance of several miles and serve to guide the traveler to the water. To the northwest, across Harper Lake, no water is to be had until one reaches Fremont Peak, but toward the north water may be obtained at the mining camps in the Black Mountains.

124. *Murphy's Well, San Bernardino County (J-4).*—This well is at the Murphy Dry-Placer Camp, about 15 miles northwest of Barstow and about 6 miles southwest of Coolgardie. Directions for finding it are not easily given, because this region for miles around has been gridironed with roads and trails over which the miners haul water to their placer camps. It is on one of the roads from Barstow to Copper City, and usually there are miners at some of the placer workings who can direct travelers to the well.

126. *Coolgardie, San Bernardino County (J-5).*—Coolgardie is the name of a small mining settlement, the cabins of the miners being scattered over several square miles of dry-placer workings. Water may be procured at the camp from the miners, who bring it in from the springs near by. The road to Coolgardie is the left-hand or west branch on the second summit north of Barstow and west of Kane's Wells (No. 129). The right-hand road at this point leads east to Kane's Wells.

127. *Well, San Bernardino County (J-5).*—This well is at the southwest end of Coolgardie Lake, the easternmost of the three dry lakes in this township. It is by the side of the road to Copper City and is readily found. The well is dug in the playa deposits and the water is of fair quality, being only slightly brackish.

128. *Indian Spring, San Bernardino County (J-5).*—This spring is about 12 miles north of Kane's Wells (No. 129) and about 4 miles north of some dry-placer mines. A road leads northward to it from Kane's Wells and thence westward by way of Coolgardie Dry Lake to Copper City, but it is a road over which there is but little travel. The spring is utilized by miners who work the dry gold placers of that region. The water is better than that along the dry lakes to the southwest, as it flows from granite. Another Indian Spring (No. 150) lies about 75 miles westward, near Rosamond Station, on the Southern Pacific Railroad.

129. *Kane's Wells, San Bernardino County (J-5).*—These wells (Pl. III, A) are about 22 miles north of Barstow on the road to Coolgardie and Copper City. After leaving Barstow the road crosses two divides, and a short distance beyond the second divide turns north-eastward to the head of a little canyon that runs eastward. Kane's stamp mill and wells are about one-fourth mile down this canyon and can not be seen by the traveler until he is near the house and the mill. There are two good wells here, both boarded up and supplied with pumps.

On looking down the canyon from the mill the traveler may see Coyote Dry Lake in the desert below, but to reach this lake or to go northward he should return to the head of the canyon. The main road leads northward from this point past the placer camps to Indian Spring and Copper City; the middle road at the summit leads north-westward to Coolgardie, about 7 miles distant. On continuing northward and following the crest of the divide on the easternmost trail, the traveler will find a road that turns eastward down the canyon. This road leads to Coyote Dry Lake. On the main Copper City road to the north, beyond the dry placer works, another road turns off toward the east, running to Paradise Springs (No. 130), but it was so badly washed out by cloud-bursts in 1905 as to make these springs difficult to find. Kane Springs (No. 84) lie west of Randsburg, while Kane's Spring (No. 176) is about 9 miles southeast of Newberry Station.

130. *Paradise Springs, San Bernardino County (J-5).*—Paradise Springs are a favorite stopping place with prospectors who know the way to them, as there is generally sufficient grass around them to afford good grazing. The best way to reach them from Kane's Wells is to follow the road from that place directly north for about 3

miles—that is, to a point about 1 mile north of the dry-placer camp. The road then turns to the east and descends along a dry wash to the foot of the main range. Here it turns to the north across a wide flat and curves finally into a large cove, in which the springs are found. The water is clear, pure, and warm, and the developed supply amounts to 2 or 3 miner's inches.

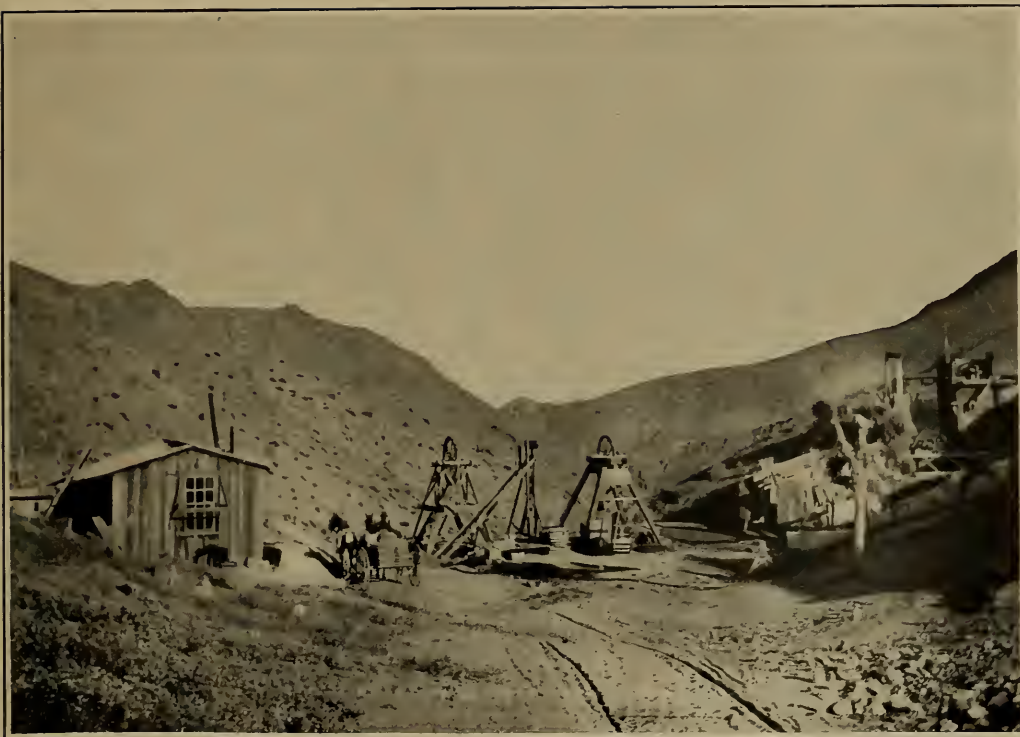
A water appropriation has been filed on the springs by the Paradise Mountain Mining and Milling Company, and a gravity pipe line laid to their workings, about 2 miles southwest.

131. *Canyon Spring, San Bernardino County (J-5).*—This spring is in a main canyon on the east side of an unnamed mountain northwest of Coyote Dry Lake. It can not be located by land lines with certainty, but it is probably in the NE. $\frac{1}{4}$ sec. 7. It is not on a main line of travel, but is near what is known as the old trail from Barstow by way of Paradise Springs to Death Valley. It is 6 miles east of Paradise Springs and about 5 miles northwest of the north end of Coyote Lake. There was once a road from Daggett along the west side of Coyote Dry Lake, which led to Canyon Spring and to Garlic Spring (No. 135). These roads are rarely traveled now by wagon and are probably obliterated for long distances by drifted sand. Usually they are less obscure near the spring than at greater distances from it. The supply of water is not large, but the quality is good.

132. *Willow Spring, San Bernardino County (J-5).*—There is a small spring of brackish water in the foothills at the north end of Coyote Lake. In 1900 water was running there in some quantity, but early in 1905 the spring could not be found, because of the effects of a storm in the vicinity some time before. It should be about 2 miles west of the main road that crosses Coyote Lake en route from Daggett to Death Valley. Its position is noted, in order that prospectors and others who traverse this country may be on the lookout for it. It often happens that springs are covered by the wash of storms and disappear temporarily, but later reappear near the old location.

133. *Coyote Well, San Bernardino County (J-5).*—Coyote Well, the first camping place on the road from Daggett to Death Valley, is about 17 miles northeast of Daggett. The traveler may go from Daggett by way of Otis and pass east of the Calico Range to the well, keeping in the open country all the way, or he may take another road which leads from Daggett northward by way of Borate. From Borate this road follows the narrow-gage railroad of the Pacific Borax Company to the divide of the Calico Mountains, then continues down the mountain slope to the main valley, where it turns eastward, following the valley to the open country, and thence northeastward to the well.

The well (Pl. III, B) is easily found, as it stands by the roadside at the south end of Coyote Dry Lake. It is about 15 feet deep and



A. KANE'S WELL.



B. COYOTE WELL.

is covered with a platform. There is a windlass and an iron pump at the well, but the pump handle was broken some time in the spring of 1905 by vandals. The water is abundant but it is slightly brackish. Small sulphur springs issue from the hills about 2 miles west of this well, but the water is small in quantity and is fit only for stock. The next water to be found on this road is about 14 miles farther north, at Langford Well (No. 134). Two other watering places, known as Coyote Holes (Nos. 78 and 209), lie about 70 miles to the northeast and to the southeast, respectively.

134. *Langford Well, San Bernardino County (J-6).*—One of the important watering places on the road from Daggett to Death Valley is a well at the southwest corner of Langford Dry Lake, about 14 miles north of Coyote Well. The water here is the best to be had between Daggett and Cave Springs. The well is about 40 feet deep and is protected by board covering. A good iron pump was put in early in 1904, but was broken in the fall of the same year by vandals. The well is readily found, as it is close by the roadside and is surrounded by the débris left by numerous camping parties.

135. *Garlic Spring, San Bernardino County (J-6).*—This is a well-known spring on the road from Daggett northward to Death Valley. It is at the west edge of the range of mountains that lies next north of Langford Dry Lake and south of Tiefert Mountain, at an elevation of about 2,455 feet. The majority of campers stop at Langford Well and do not stop at Garlic Spring, because the water there is strong with sulphur, and sodium and magnesium sulphates.

136. *Bitter Spring, San Bernardino County (J-7).*—This spring is near the southeast end of Bitter Lake, on the old emigrant road to Salt Lake City. It is the first watering place the traveler reaches on this road after passing Alvord Mountain. It is also on the road from Daggett to the Shadow Mountains, and is one of the principal stopping places on that road. It has been known since 1852. The water contains too much sodium sulphate to be wholesome, but it can be used.

137. *Cronese Spring, San Bernardino County (J-7).*—This spring is at the southeast end of Cronese Dry Lake, at the southwest base of the Soda Lake Mountains. It is well known to desert prospectors, but not being near one of the principal routes is not known to casual travelers. The water is slightly brackish but not unwholesome. By digging a shallow well here enough water could probably be developed to irrigate a few acres.

138. *Barrel Spring, San Bernardino County (J-7).*—This spring, at one time an important point on the old emigrant road to Salt Lake, is near the south end of the Soda Lake Mountains, about 15 miles east of Afton and 10 miles southwest of Government Well, at

Soda Lake (No. 139). It is near a rocky point where the road from Daggett north to Government Well rounds a spur of the Soda Lake range. It is a small spring, protected by a barrel sunk in the ground. Since the building of the Salt Lake Railroad it has lost its importance to travelers.

139. *Government Well at Soda Lake, San Bernardino County (J-8).*—At Soda Lake, a station on the Tonopah and Tidewater Railroad, is one of the wells dug by government troops forty or fifty years ago. It is on the eastern branch of the old emigrant road from San Bernardino to Salt Lake City by way of Mohave River, and is near the west edge of the sink of the Mohave, at the eastern base of the Soda Lake Mountains. The well is easily found, because its position is marked by the ruins of the old adobe and stone buildings erected by the troops. The water is a part of the underflow of Mohave River, and is of fair quality, in spite of the heavy deposits of soda that whiten the surface all about it.

The well is a pool lined with stone, about 5 by 8 feet in dimensions and 3 feet deep. It is near the edge of some tules about 150 feet southeast of the largest stone building. The buildings are on the north side of a limestone knob, and the traveler can not see them from the road until he is within 100 yards of them. This knob, however, near the middle of the western edge of Soda Lake, serves as a guide to their position. The tules, which can be seen from a distance as one approaches the well, also aid in finding it.

The next water north is at Dante Springs (No. 140), on the road to Halloran Springs and Ivanpah.

A road leads northward from Government Well by way of Silver Dry Lake to Death Valley. It passes between the Avawatz and Shadow mountains, but there is no water to be had along it until one reaches Williams Well, at the west end of Silurian Mountain, a distance of about 25 miles, unless one turns off to Berry or to Silver Lake.

140. *Dante Springs, San Bernardino County (J-8).*—These springs are, as near as can be determined, in the southeast quarter of section 28. They are on the north side of the butte that stands at the northeast end of Soda Lake, on the road from Government Well, at Soda Lake, to Halloran Springs and Valley Wells (Rosalie). It is about 12 miles from Dante Springs to Halloran Springs. The water is of good quality, but its quantity is not large.

141. *Borax Well, San Bernardino County (J-8).*—This is a well dug by miners on the east side of Soda Lake, about 7 miles nearly due east of Soda Lake station. A road leading from Balch, on the Salt Lake Railroad, to Dante Springs passes it. The well is about 20 feet deep and the water is soft and of fair quality. Analysis

shows the presence of borax and of a small amount of sodium sulphate.

142. *Well near Soda Lake, San Bernardino County (J-8).*—A well is reported to exist near the south end of Soda Lake, $2\frac{1}{2}$ miles southeast of Epsom station, on the Salt Lake Railroad. The supply of water is said to be good, but the well is not of great importance, because travelers can obtain water at a more convenient point, Balch station, where most of the desert wagon roads leave the Salt Lake Railroad.

143. *Spring near Soda Lake, San Bernardino County (J-8).*—Prospectors report that there is a good spring at the north end of Old Dad Mountains, about 4 miles southeast of Balch.

144. *Marl Springs, San Bernardino County (J-9).*—There are springs of good water at the north end of a small butte about 9 miles southwest of Cima station, on the Salt Lake Railroad. They are on the old road from Kessler Springs to Soda Lake. They have been used for years by prospectors, and are marked by the traces of old camps beside the road.

145. *Government Holes, San Bernardino County (J-10).*—This watering place is 5 miles northeast of Elora, on the Salt Lake Railroad. More than forty years ago a military road extended from Fort Mohave, Ariz., across the desert to Mohave Sink and up Mohave River. This supply road passed the old Piute Springs (No. 149), the Mid Hills, and Soda Lake, and at old Camp Cady on Mohave River joined the emigrant trail from San Bernardino to Salt Lake.

One of the wells dug along this road by the troops, years ago, is known as Government Holes. The well stands at an elevation of 5,100 feet, on the west side of the Mid Hills, a range of low buttes just east of the north end of the Providence Mountains and south of the west end of the New York Mountains. The tops of the Mid Hills show granite pinnacles, and the well at their base is plainly marked, as various desert roads converge to it. The well is protected by a corral, and a ranch house stands near it. The water is very good.

146. *Out West Well, San Bernardino County (J-10).*—This is a well dug at the camp of the Out West Mining Company along the west side of the Mid Hills, about 4 miles in an air line southwest of Government Holes (Pl. II, *B*). A well-traveled wagon road leads westward from Government Holes to the head of Black Canyon and down the canyon for about 1 mile. It then turns back toward the east for a few rods and northward to the Out West camp. The camp is marked by a stone house and by the old frames of tent houses. The well is dug in granite and is protected by curbing. It is about 40 feet deep and usually contains 15 feet or more of sweet, pure water.

There is no other water to be had along a road that runs southward through Black Canyon until the old mining camp of Providence (No. 164) is reached, about 25 miles northwest of Fenner.

147. *Rock Springs, San Bernardino County (J-10).*—These springs lie 6 miles southeast of Government Holes, on the old government road running to Fort Mohave, Ariz. They are easily found and the water is of good quality, although the quantity is not large.

148. *Vontreger Springs, San Bernardino County (J-11).*—These springs are about 9 miles north of Goffs Station (Blake post-office), on the Santa Fe Railway, in the low hills east of the branch line that runs from Goffs to Barnwell, in a canyon on the south side of the summit of the hills. They are easily found, and their water is abundant and good. There is no other water on the road north of these springs until Barnwell is reached.

149. *Piute Springs, San Bernardino County (J-11).*—These are well-known springs in Piute Pass, about 15 miles north of Goffs Station, on the Santa Fe Railway. They are on the old military road that leads from Fort Mohave to Government Holes, and roads lead to them from Goffs, Ibis, and Blackburn Siding. There are other springs of the same name, about 20 miles northward, just across the state line in Nevada.

150. *Indian Spring, Kern County (K-1).*—This is a strongly flowing spring, about 3 miles northeast of Rosamond Station, on the Southern Pacific Railroad. It is near the northwest edge of Rosamond Dry Lake, on the wagon road that runs from the railroad to Buckhorn Spring (No. 152). Water fit for stock can be obtained here. There is another spring (No. 128) of the same name, on a little-traveled road between Daggett and Copper City.

151. *Rodriguez, Kern County (K-2).*—This is a pumping station on the Santa Fe Railway, 18 miles east of Mohave. The railway company has sunk a well 40 feet deep at the west edge of Rodriguez Dry Lake, and procured an abundant supply of water of fair quality.

152. *Buckhorn Spring, Kern County (K-2).*—Buckhorn Spring has been well known to desert travelers for over thirty years. It is on the west side of Rodriguez Dry Lake, about 7 miles south of Rodriguez Station, on the Santa Fe Railway, and about 15 miles east of Rosamond Station, on the Southern Pacific. A cabin belonging to a prospector who has lived there for years stands near the spring, which is therefore easily found. The water, although slightly brackish, is of fair quality. There are other springs about the lake border. One of these is about 6 miles southeast of the wells, on the east edge of the lake, the road to it passing around the margin, and another is about 3 miles north.

153. *Spring at Rodriguez Lake, Kern County (K-2).*—A spring exists on the west edge of Rodriguez Lake, about 4 miles northeast of

Buckhorn Spring. It is said to be a little salty, but it can be used by men as well as animals. It is not important, however, because Buckhorn Spring is near by.

154. *Flowing Wells, Kern County (K-2).*—Artesian wells were drilled several years ago on the east side of Rodriguez Dry Lake, 7 miles east of the Santa Fe station of the same name, about 15 miles by road southwest of Kramer, and about 7 miles northeast of Buckhorn Spring. The water is reported to be abundant and of excellent quality, and the wells are at the northeast end of a considerable area in which artesian waters have been developed.

155. *Kramer, San Bernardino County (K-3).*—Kramer (elevation 2,479 feet, according to Santa Fe Railway) is the junction point of the Santa Fe main line and the branch leading north to Randsburg and Johannesburg. It is about 174 miles from Los Angeles by way of Barstow, and 38 miles east of Mohave. The railway company has recently drilled a well at this point, and water can now be procured here by travelers. A good wagon road parallels the railway to Randsburg, on which water may be obtained at Fremont station, Francis Well, and St. Elmo. A wagon road also leads from Kramer to Victorville, about 35 miles southeast.

156. *Well at Harper Lake, San Bernardino County (K-4).*—There is a well about $1\frac{1}{2}$ miles south of Black's ranch and about one-half mile east of the road from Hinkley to Black's. The well is in an open alkali flat and was once used for watering the ranch stock. The water is brackish and the watering place is not important, for Black's Well is near by.

157. *Hinkley Well, San Bernardino County (K-4).*—Hinkley is a pumping station on the Santa Fe Railway about 10 miles west of Barstow. There is no town at this point, but the site is marked by the pump and section houses. The company has a well 70 feet deep from which to fill its tanks. The traveler may procure a supply from these.

158. *Newberry Springs, San Bernardino County (K-6).*—There are large warm springs about 600 yards south of Newberry station on the Santa Fe Railway. The water is clear and pure and is used by prospectors en route to the mountains farther south. The Santa Fe company has built a circular masonry reservoir about the springs and pumps from them through an 8-inch pipe line. The water is hauled in tank cars to supply locomotives at Ludlow and Bagdad.

160. *Willow Springs, San Bernardino County (K-9).*—These springs are at the southwest end of Granite Mountain and are marked by a clump of willow trees. They are about 20 miles northwest of Cadiz station on the Santa Fe Railway and at about the same distance southwest of Kelso station on the Salt Lake Railroad. A pros-

pector's trail leads to them from Kelso along the east side of Granite Mountain.

161. *Cove Springs, San Bernardino County (K-9).*—These springs are at the southeast edge of Granite Mountain, about 6 miles south of Cottonwood Springs (No. 162). There is a road from them to Kelso station on the Salt Lake Railroad. The quantity of water is limited, but the quality is excellent, as the springs have their source in granite. They should not be confused with Cave Springs (No. 73) in the Avawatz Mountains.

162. *Cottonwood Springs, San Bernardino County (K-9).*—These springs, which yield good water, are at the southwest end of the Providence Range, in the pass between that range and Granite Mountain. There is a road from Kelso station, on the Salt Lake Railroad, southward to the springs, which are about 15 miles by road from the station.

163. *Bonanza Well, San Bernardino County (K-9).*—This is a well sunk by the Bonanza King Mining Company about one-fourth mile northeast of the mine hoist. It is known also as the Providence Well. It is on the east side of the Providence Mountains, near the base of the principal peak of the range, about 25 miles northwest of Fenner station, on the Santa Fe Railway. The well was drilled to a depth of 250 feet, the water rising within 100 feet of the surface. It has its source, apparently, in a porous limestone. The water is of fair quality. There is no water on the road from Fenner to this well, and there is only one other watering place in the vicinity, the old Providence Wells (No. 164), at the mill, $2\frac{1}{2}$ miles to the northeast.

It is probable that a considerable water supply could be obtained along the east edge of this range, and that a small area might be irrigated with it by the use of pumping machinery.

There are springs of the same name at No. 180, about 18 miles to the south.

164. *Providence Wells, San Bernardino County (K-9).*—These are old wells near the east edge of Providence Mountains. Their position is marked by the ruins of a little settlement and the old silver mill of the Providence Mining Company (Pl. IV, A). Usually there are miners stopping at one of the houses of the old camp. The water from the wells is excellent, and the evidences of former rather extensive cultivation indicate that it must be present in some quantity.

165. *Fenner, San Bernardino County (K-11).*—Fenner (elevation 2,084 feet) is a settlement on the Santa Fe Railway, 269 miles east of Los Angeles. The railway company has drilled a well 800 feet deep at the station and installed a large pumping plant. The water is of good quality and the supply is large.

Fenner is the trading and supply point for the Providence Mountain and adjacent mining districts. A road leads from it north-



A. PROVIDENCE WELLS.



B. ARTESIAN WELL AT BOX S RANCH.

westward to the camp of the Bonanza Mining Company. This road, which may be seen from the station, crosses the desert in a straight line directly toward the prominent Providence Range. About 12 miles from the railway an obscure road branches from it toward the north, going past the east spur of the range. It leads up Black Canyon to Government Holes (No. 145). Near the head of Black Canyon, about 26 miles north of Fenner, on the east side of the road, can be seen the shaft houses of the Out West Gold Mining Company and the road to them. A well-defined trail leads from the shafts eastward across the ridge about a quarter of a mile, to the mining company's camp. There is no water on the main road between Fenner and Government Holes.

166. *Goffs, San Bernardino County* (K-11).—Goffs (Blake post-office) is a station on the Santa Fe Railway 279 miles east of Los Angeles. It is the junction point from which a line runs northward to Ivanpah, crossing the Salt Lake Railroad at Leastalk. The railway company has drilled a well at Goffs and has installed a pumping plant, from which water may be obtained by the traveler. A good wagon road leads from Goffs northward along the railway. Water may be obtained on this road at Vontreger Springs, about 9 miles north of Goffs.

167. *Ibis, San Bernardino County* (K-12).—Ibis is a station on the Santa Fe Railway about 296 miles from Los Angeles, just east of the summit that the railway crosses before descending to Needles. A wagon road leads northward from the station to Searchlight, and to Eldorado, Callville, and other points on Colorado River in Nevada. The railway company has drilled a well here 300 feet deep and installed a pumping plant. The water is found in cemented gravel and is of excellent quality. Ibis is merely a siding and watering station, and those who need supplies must procure them at Needles.

168. *Klinefelter, San Bernardino County* (K-12).—Klinefelter (elevation 1,445 feet, according to the Santa Fe Railway) is a station on the Santa Fe 299 miles east of Los Angeles. The railway company has installed a large pumping plant here to supply its locomotives. The water is taken from large springs that rise in the deep gravels of the Sacramento Wash. This station is the main source of supply for miners prospecting in the Sacramento Mountains, and travelers can always find water here.

169. *Needles, San Bernardino County* (K-12).—Needles (elevation 491 feet, according to the Santa Fe Railway) is in the valley of Colorado River. This city is the principal supply point for miners and prospectors in the eastern end of the Mohave Desert. The railway company has large machine shops here, and wholesale stores carry an abundance of supplies of all kinds. The water, which is

easily obtained from shallow wells, is of excellent quality, and miners going into the mountains to the north and west are advised to start from Needles with an ample supply, as there is very little to be found within a radius of 20 miles or more except along the railway and the river.

170. *Victorville, San Bernardino County (L-4).*—Victorville is on the main line of the Santa Fe Railway and is the starting point for the most important county roads running east and west along the north base of the San Gabriel and San Bernardino mountains. Mohave River, which flows through the town, is crossed here by means of a bridge, but at other points above and below it must be forded. Ordinarily this is a simple matter, but occasionally, in fall and winter, when travel on the desert is at its maximum, heavy storms in the mountains so increase the flow in the river as to render it unfordable.

The railway company has a well and pumping plant at Victorville, and artesian wells have been developed in the vicinity, so that there is always an abundance of water to be had here. The town is also an outfitting point where teams and supplies of all kinds may be procured.

171. *Colony Well, San Bernardino County (L-4).*—This well is about 9 miles east of Victorville and about $4\frac{1}{2}$ miles north of the county road that runs southeastward from the town. It was dug to supply an agricultural settlement that has recently been established in the desert. The well is about 50 feet deep and yields a limited supply of water of poor quality.

172. *Spring (no name), San Bernardino County (L-4).*—This is a spring on the south side of a western spur of Granite Mountain, about 14 miles northeast of Victorville, on the main road from Victorville to Daggett. The water is good and the place is well marked by débris left by numerous camping parties. This spring furnishes the only water to be obtained on this road between Victorville and Daggett. The main trend of Granite Mountain is north and south, but at the north end a cross ridge runs east and west. This spring is along the south edge of the western extension of this ridge.

173. *Ord Spring, San Bernardino County (L-5).*—This spring is located at the western edge of Ord Mountain, on the road that leads southward from Daggett between Ord and Granite mountains. It is an old camping place and is readily found. A road runs southward from it along the east side of Granite Mountain to the county road at Dead Man's Point, and another connects with the county road from Victorville to Daggett. The water is of good quality.

174. *Le Conte Springs, San Bernardino County (L-5).*—These springs are at the east end of Ord Mountain, about 35 miles east of Victorville and 22 miles southwest of Newberry, on the road that con-

nects these two points. The road is well traveled and the springs are plainly marked by the rubbish left by campers.

175. *Willow Springs, San Bernardino County* (L-5).—These springs are at the north end of Ord Mountain, about 5 miles in an air line north of Le Conte Springs, and about 15 miles south-south-east of Daggett. There is no road or trail leading directly to them and they are used only by prospectors who know of their location. The water is of good quality. Travelers from Victorville to Newberry Springs can obtain a supply of water at Le Conte Springs, which are much more easily found.

176. *Kane's Spring, San Bernardino County* (L-6).—There is a spring of good water at the east base of Kane Mountain, about 6½ miles southwest of Troy station and about 9 miles by road southeast of Newberry station, on the Santa Fe Railway. The spring is on the wagon road from Victorville to Newberry by way of Dead Man's Point and Le Conte Springs.

177. *Spring (no name), San Bernardino County* (L-16).—This spring is in the pass between Bessemer Mountain and a western extension of the Bullion Mountains, about 12 miles south of Hector siding, on the Santa Fe Railway, and about 6 miles south of the road from Newberry station to Mean's Well (No. 198). It is not on any main road. The water is slightly brackish, but is used by the miners who are developing the iron deposits in Bessemer Mountain.

178. *Peacock Spring, San Bernardino County* (L-7).—This spring is at the northwest end of the Bullion Mountains, south of a dry lake. It is about 10 miles from Lavic station, on the Santa Fe Railway, by a wagon road that leads southward from Lavic to Mean's Well (No. 198) and the San Bernardino Mountains. No other water is to be had along this road until Mean's Well is reached, 15 or 20 miles farther to the southwest. The position of the spring is marked by the dry lake and by rubbish of the kind usually found at all old desert camping places.

179. *Mascot Spring, San Bernardino County* (L-8).—There is said to be a spring at the base of the lava flow near the northwest edge of Bristol Dry Lake, about 4½ miles south of Bagdad station.

180. *Bonanza Springs, San Bernardino County* (L-10).—There are springs of good water at the south edge of Clipper Mountain, about 6 miles northwest of Danby station, on the Santa Fe Railway. A local road from Danby leads to them. They are used chiefly by prospectors in Clipper Mountain.

Bonanza well and Providence wells lie about 18 miles north of these springs.

181. *Siam, San Bernardino County* (L-10).—This is a pumping station on the Santa Fe Railway about 6 miles southwest of Danby, in a little pass at the north end of Ship Mountain through which the

railway runs. It is the first station east of Cadiz. The wells sunk by the railway company at this point are not deep, but they supply a large amount of excellent water, which is procured from underlying gravels.

182. *Danby, San Bernardino County (L-10).*—Danby (elevation 3,024 feet, according to the Santa Fe Railway) is a settlement on the line of the Santa Fe 253 miles east of Los Angeles. It is a local supply point for miners operating in Old Woman Mountain, Clipper Mountain, Danby Dry Lake, and at other places in the region. The railway company has drilled a well 637 feet deep and installed a good pumping plant, at which travelers can fill their barrels and canteens. The water is of excellent quality. A good road runs from Danby southward on the west side of Old Woman Mountain to the house built of rock salt on Danby Dry Lake, thence southward to Miller's well (No. 216), at the southwest end of the lake. From Miller's Well the road leads to the Maria Mountains, where there are mining settlements, and thence to Ehrenberg, Ariz. This is the only road southward from Danby. In 1908 a well 60 feet deep was sunk by the side of the road at the north end of Danby Lake, about 2 miles northeast of the Salt House. This well is equipped with a windlass and yields excellent water. The water of Miller's Well is not of good quality, but will serve for animals. Water is next found 15 or 20 miles beyond Miller's well at Brown's well (No. 232).

183. *Old Woman Springs, San Bernardino County (L-11).*—There are large springs in the main canyon on the east side of Old Woman Mountain, named, as is the mountain itself, from a granite pinnacle at the crest of the range. There is no regularly traveled route along the east base of this mountain, nearly all of the travel being by way of the Danby road on the west side. There is, however, a dim trail, washed out in many places, from Danby Dry Lake on the south along the base of the mountain to these springs. The water in the springs rises from granite and is pure and sweet. These springs should not be confused with those of the same name (No. 196) about 35 miles east of Victorville.

184. *Sunflower Springs, San Bernardino County (L-11).*—These springs are on the eastern border of a northern extension of Old Woman Mountain, about 12 miles in an air line southeast of Fenner. The springs are in a cove about half a mile up a canyon which intersects the mountain. There are neither roads nor regular trails to them, but they may be found by the cattle paths that lead to them. The water comes from limestone and is of good quality.

185. *Mellen, San Bernardino County (L-13).*—Mellen (elevation 420 feet, according to the Santa Fe Railway) is a station on the Santa Fe, about 9 miles southeast of Needles, near Colorado River. The railway company has sunk a well in the alluvium of the valley

and installed a pumping plant over it. It is the water-supply point for prospectors in the near-by points of the Mohave Mountains to the south and the Sacramento Mountains to the west.

186. *Burcham ranch, San Bernardino County* (M-4).—This is a well-known ranch near the head of Mohave River, in San Bernardino County, about 7 miles in an air line east of Summit station, on the Santa Fe Railway. It is reached by a road from Cajon Pass that runs through Horsethief Canyon and thence down the river. There is a horseback trail from this ranch to the head of the river and another southward into the San Bernardino Mountains. There is always flowing water in the Mohave River at the ranch.

187. *Dead Man's Lake Well, San Bernardino County* (M-5).—Dead Man's Lake is the first dry lake on the county road that leads from Victorville eastward to the Rose mine, in the San Bernardino Mountains. It is about 18 miles east of Victorville, just beyond a granite spur that projects toward the road from a group of mountains to the north. Near the north edge of this dry lake miners are reported to have drilled a 300-foot well, in which the water rises within 150 feet of the surface. The well is not on the road and can not be seen from it, but a dim trail goes northward across the dry lake to it. The next water is at the Box S Ranch, about 6 miles southeast of this point.

188. *Rabbit Springs, San Bernardino County* (M-5).—Rabbit Springs (elevation about 2,900 feet) have for years been a favorite camping place for parties traveling eastward from Victorville along the north flank of the San Bernardino Range. The springs are about 2 miles north of Box S ranch, on the northwest edge of Rabbit Dry Lake, and are marked by a clump of cottonwood trees that can be seen from the low divide 3 miles west. Since artesian water was found at Box S ranch, travelers have generally followed the road that passes it. At the east edge of the dry lake just west of Box S ranch a road turns to the left (northward) from the main road and crosses a saddle in a rocky point just ahead, while the main road passes south of this point. This left-hand road leads to Rabbit Springs. Some freight teams follow it as the distance is a little less to Copper Well (No. 195), Old Woman Springs (No. 196), and Mean's Well (No. 198) than by way of Box S ranch.

The waters of Rabbit Springs are presumably artesian, and derived from the same source as are those of the Box S wells. The supply is sufficient to irrigate a section or more of land.

189. *Box S ranch, San Bernardino County* (M-5).—Box S ranch (Pl. IV, B), elevation 2,935 feet according to U. S. Geological Survey), should not be confused with Box S Springs (No. 192), which are about 6 miles southeast of the ranch. The ranch receives its name from the cattle brand of the company that owns it, the brand being a square inclosing the letter S. The ranch is about 24 miles east of

Victorville, on the county road that leads to the mines in the San Bernardino Mountains, and eastward into the desert. Several wells have recently been drilled at the ranch and in its vicinity, some of which yield flowing water, so that an abundant supply is now available. The locality is easily recognized because of the ranch buildings, the first to be seen by the traveler after he leaves Mohave River at Victorville. It is an important point for desert travelers, because the water is the first to be had along this road east of the river. Meals also may be obtained here.

190. *Spring (no name), San Bernardino County (M-5).*—This is a small spring along the north face of the San Bernardino Mountains, almost due south of Dead Man's Point. It supplies miners who are developing copper prospects in the vicinity. Their tent houses may be seen to the south from the county road that extends from Victorville east.

191. *Lucerne Valley Well, San Bernardino County (M-5).*—In the winter of 1905-6 a well was drilled at the Lucerne Valley ranch, which is about one-half mile north of the wagon road from Rabbit Springs to Old Woman Springs (No. 196). The site, like that of Box S ranch, is marked by buildings.

192. *Box S Springs, San Bernardino County (M-5).*—These springs issue at the base of a low alkaline terrace just north of the road that leads from the Box S ranch southeastward to the Rose mine, in the San Bernardino Mountains. A trough stands by the roadside, and the water is conducted to it by an iron pipe. There is a small but constant flow, and the water is sufficiently free from salts for all purposes. Cushenbury Springs (No. 193) are only about 3 miles distant to the southeast, and the Box S ranch is about 6 miles northwest.

193. *Cushenbury Springs, San Bernardino County (M-5).*—Cushenbury Springs are on the county road that runs from Victorville to Gold Mountain, Doble, Holcomb Valley, and the Rose mine, which are all in the San Bernardino Mountains near Bear Lake. The springs are at the base of the San Bernardino Range near the mouth of a canyon at an elevation of 4,042 feet (U. S. Geological Survey) and are 9 or 10 miles southeast of Box S ranch and about 3 miles beyond Box S Springs. They are marked by a clump of tall cottonwood trees, with alfalfa fields to the south and east and a dwelling among the cottonwoods. There is a good corral and a watering trough by the roadside, to which the water is piped. The yield of the springs is from 3 to 4 miner's inches.

194. *Cactus Flat Springs, San Bernardino County (M-5).*—Cactus Flat Springs (elevation about 5,900 feet) are near the northern crest of the San Bernardino Mountains on the fruit ranch of Mr. J. C. Johnson, who has lived here many years and is the postmaster of Cactus Flat. The ranch and springs are about 6 miles southeast of Cush-

enbury Springs, on the county road from Victorville to Gold Mountain, Holcomb Valley, and the Rose mine. The place is very readily found, as the road, which is well graded and well traveled, runs near the orchard, the house, and the corrals. Troughs are built by the side of the road for watering horses. The springs yield sufficient water to irrigate a number of acres of fruit land. A small stock of canned goods and other supplies is kept by the postmaster, so that travelers may replenish a depleted larder here.

195. *Copper Well, San Bernardino County* (M-5).—This is a new well, recently sunk by miners who are at work on some gold and copper prospects at the east end of Lucerne Valley. It is on the road from Box S ranch to Old Woman Springs (No. 196) and is marked by the miners' buildings.

196. *Old Woman Springs, San Bernardino County* (M-6).—These large springs are at the north base of the San Bernardino Mountains, about 12 miles east of Box S Springs, on the north road from Victorville to Dale, at an elevation of 3,186 feet (U. S. Geological Survey). They should not be confused with the other Old Woman Springs (No. 183) about 90 miles farther east. The water is somewhat alkaline, like that at Box S Springs. The site is marked by a group of cottonwood trees, a ranch house, an orchard, and an alfalfa field. The springs are said to yield from 8 to 30 miner's inches, varying with the season. Hay may be purchased and other accommodations may be had at the ranch at these springs.

197. *Rock Corral, San Bernardino County* (M-6).—A well-known spring, marked by an old rock corral, is situated at the north edge of the San Bernardino Range, about 9 miles west of south from Mean's Well (No. 198), at an elevation of 3,600 feet. The water is abundant and good.

198. *Mean's Well, San Bernardino County* (M-6).—The Gold Pin Mining Company has dug a well 26 feet deep at the northwest edge of Mean's Dry Lake. The water rises within 12 feet of the surface. The company has installed a 12-horsepower gasoline engine to pump the water to its mine, which is in the mountains directly north of the lake. The next water on the west is at Old Woman Springs, about 12 miles distant, but there is another well (No. 199) about 6 miles southeast of Mean's Well on the road to Dale.

199. *Wilbur Well, San Bernardino County* (M-6).—This well is about 6 miles southeast of Mean's Well and about 16 miles west of Surprise Spring (No. 200) on the country road from Victorville by way of Mean's Well to Dale. The water is of good quality, and the well is easily found, as it is close by the roadside.

200. *Surprise Spring, San Bernardino County* (M-7).—This spring is on the county road from Victorville to Dale by way of Mean's Well, about 6 miles west of Mesquite Dry Lake, about 16 miles east of

Mean's Well, and about 12 miles north of Mesquite Spring. (No. 211). The spring receives its name from the fact that it is in the open desert where one would least expect to find water. It is close to the roadside, and the location is clearly marked by camp débris. The water is of fair quality.

201. *Dead Man's Hole, San Bernardino County* (M-7).—The springs known under this name are on the west side of Mesquite Dry Lake and east of the county road. They are little more than mud holes in the playa deposits around the lake. The water is full of magnesia and soda salts and is very laxative, but can be used by animals.

202. *Spring (no name), San Bernardino County* (M-8).—This is a spring at the northeast side of the Bullion Mountains, near some old mine workings about 4 miles west of Bristol Lake and about 8 miles southwest of Bagdad station, on the Santa Fe Railway. A trail leads from the station to the spring, which is used only by local prospectors.

203. *Spring (no name), San Bernardino County* (M-10).—This spring is on the west side of Old Woman Mountain, on an old road that runs from Dale northward to a point about 9 miles south of Cadiz, where it turns eastward and crosses the road from Danby station to Danby Lake. It is the first road crossed in driving south from the railway at Danby. The spring is about 6 miles east of the Danby road, in the main canyon of the mountain, and is marked by the ruins of a mining camp. A mill stood near the spring at one time. The supply of water is not large, but the quality is excellent.

204. *Springs (no name), San Bernardino County* (M-10).—These are small springs in the southern end of Old Woman Mountain, about 6 miles north of Danby Lake and about 3 miles east of the road from Danby station to the lake. This road crosses a dry wash containing cottonwood trees, and the springs are found by following this wash into the mountains. They are not on a main road and are not particularly well known, but are used by prospectors. The water flows from granite and is of good quality.

205. *West Well (new), San Bernardino County* (M-13).—This well is on the county road from Needles, Cal., to Parker, Ariz., and is about 30 miles south of Needles, 4 miles southwest of the old West Well (No. 206), and 25 miles northwest of Parker. It is close by the roadside, is protected by curbing, and is provided with a pump and a covered watering trough. The supply of water is sufficient for all needs.

206. *West Well (old), San Bernardino County* (M-13).—This well is near the head of the Chemehuevis Wash, on the county road that runs from Needles, Cal., to Parker, Ariz. It is about 40 feet deep and stands in a clump of cottonwood trees. It is protected by curbing and

provided with an iron pump and a good watering trough with cover. The water rises within about 6 feet of the surface and is of excellent quality.

Since this well was dug the county road has been straightened. The main road now diverges from the old road about 3 miles west of this well and continues southward into the next township, where a new well has been dug. The old well is convenient for prospecting parties in the Chemehuevis Wash.

207. *Warren's ranch, San Bernardino County (N-6).*—This well-known ranch is 28 miles northeast of Banning, at the highest point along the road from Banning to Dale, its elevation being 2,500 feet. It is the usual stopping place for all travelers bound from the north end of the Colorado Desert or from San Gorgonio Pass northeastward by way of Morongo Pass. It is a road ranch and provides travelers with meals, hay, grain, and other supplies. The water used flows from large springs and is pumped to the ranch by a gasoline engine.

208. *Warren's Well, San Bernardino County (N-6).*—This well is 10 or 12 miles east of Warren's ranch. It is 150 feet deep, and the water is pumped by a windmill into a cemented reservoir about 18 feet long, 10 feet wide, and 4 feet deep. Fifteen cents is charged for each team watered here. It is 27 miles by road from the well to Twenty-nine Palms Springs (No. 213).

209. *Coyote Holes, San Bernardino County (N-7).*—This watering place, originally of some importance but now fallen into disuse, is about 7 miles east of Morongo Pass, at the junction of the wagon roads from Victorville, on the Santa Fe, and Banning, on the Southern Pacific. It is about 18 miles by road from Coyote Holes eastward to Twenty-nine Palms Springs and about 9 miles west to Warren's Well. Warren's Well and the springs at Warren's ranch now supply travelers with water, so that Coyote Holes are no longer used and have become badly choked with sand. A slight seepage, however, may be found in a canyon about 1 mile south of the road junction.

210. *Quail Springs, San Bernardino County (N-7).*—These springs are at the north edge of the San Bernardino Range, about 6 miles southeast of Coyote Holes. The water is excellent and the supply can no doubt be increased.

211. *Mesquite Spring, San Bernardino County (N-7).*—Mesquite Spring is on the road from Victorville to Dale by way of Mean's Well, about 3 miles south of Mesquite Dry Lake and 7 miles northwest of Twenty-nine Palms Dry Lake. Its site is marked by granite outcrops, a mesquite grove, and the débris of old camps. The water is of good quality and the supply is ample for travelers.

212. *Sulphur Springs, San Bernardino County (N-8).*—These springs are about 2 miles south of Mesquite Springs, on the county

road from Victorville to Dale. The water is abundant, but tastes strongly of sulphur; and as it is but a few miles southward to other and better springs these are rarely used by travelers.

213. *Twenty-nine Palms Springs, San Bernardino County (N-8).*—The Twenty-nine Palms Springs are scattered for a distance of a mile along the southwest edge of Twenty-nine Palms Dry Lake, about 6 miles south of the south end of the Bullion Mountains, on the roads from Victorville and Banning to Dale and 27 miles east of Warren's Well. They receive their name from the clumps of native palms growing about them. An adobe building stands near the camping place. The water at the springs is abundant enough to supply a number of mining camps in the vicinity. There are several shallow wells near the springs, from which water may also be procured.

214. *Dale Pump, San Bernardino County (N-9).*—A pumping plant has recently been installed at the south edge of Dale Dry Lake, in T. 1 N., R. 12 E., the well, however, being just over the township line to the south. This plant supplies water to Dale, a mining settlement about 5 miles farther south. Dale, long known as Virginia Dale, is the post-office and trading center for the prospectors in the mountains around it. The location of this settlement has been changed several times during the last ten years, but with the development of water its present position will probably prove permanent. The well is reported to furnish an abundant supply of water of good quality.

215. *Desert Well, San Bernardino County (N-11).*—This well is reported to have been drilled near the southeast edge of Iron Mountain, about 4 miles southwest of Miller's Well (No. 216). The writer searched for it recently, but was unable to find it, although it is said to be in the SW. $\frac{1}{4}$ sec. 3, T. 1 S., R. 18 E., San Bernardino meridian. From the abundance of water plants, however, it is evident that water can be procured without much difficulty in that vicinity.

216. *Miller's Well, San Bernardino County (N-11).*—Miller's Well is situated on the southwest edge of Danby Dry Lake, among the gypsum knobs at the east base of Iron Mountain. It is beside the road that runs southeastward from Danby station, on the Santa Fe Railway, to the Maria Mountains. The well is about 35 or 40 miles south-southeast of Danby. Brown's Well (No. 232) is 20 miles southeast. The water is dark colored and very salty, and only thirsty animals will drink it. Travelers, therefore, should carry with them from Danby an ample supply for men and teams. It is reported that there is another well on the southwest side of Iron Mountain, but the writer was unable to find it. There are two other Miller wells (Nos. 299 and 301) in Nevada, but this well is not likely to be confused with them.

217. *Spring, San Bernardino County (N-12).*—There is a spring near the southeast end of the Turtle Mountains, about 15 miles north-east of Brown's Well (No. 232) on the road to the West Well (No. 205). The water is good.

218. *Palm Springs station, Riverside County (O-6).*—Palm Springs is a station on the Southern Pacific Railroad in the upper end of the Colorado Desert. It is supplied with water from wells. This station should not be confused with Palm Springs proper, which lies at the base of San Jacinto Peak, 6 miles due south. (See No. 219.)

219. *Palm Springs, Riverside County (O-6).*—This is an agricultural settlement and health resort in the upper end of the Coachella Valley, about 6 miles south of Palm Springs station on the Southern Pacific Railroad, at an elevation of 455 feet (U. S. Geological Survey). The lands of the settlement are irrigated in part from these rather large springs, and in part from Whitewater River and the near-by canyons of the San Jacinto Mountains. There are a number of springs here, and some of them are thermal and medicinal. The settlement is named from the wild palms which grow in the vicinity. It is one of the most northerly points in the United States at which these plants are found native.

220. *Palmdale, Riverside County (O-6).*—This agricultural settlement, now largely abandoned, is about $2\frac{1}{2}$ miles southeast of Palm Springs, at an elevation of about 450 feet. Its irrigation was accomplished by utilizing a group of springs that give a good supply of water.

221. *Magnesia Spring, Riverside County (O-6).*—This is a spring of effervescing magnesia water in Magnesia Spring Canyon, about 15 miles west of Indio. The mouth of the canyon is about 2 miles southwest of the Indio road, which passes along the south side of Coachella Valley. A dim trail turns to the southwest from this main road at a point about 6 miles west of Indian Well (No. 234) and leads up to the spring.

222. *Stubby Springs, Riverside County (O-7).*—These springs are on a trail from Palm Springs station to what is known locally as the Thousand Palms Canyon. This canyon is at the southwest edge of the San Bernardino Range, about 18 miles north of Indio. The springs were opened by a freighter known locally by the nickname "Stubby," who made the trail into the canyon.

223. *Lost Horse Spring, Riverside County (O-7).*—This is a spring near the summit of the San Bernardino Mountains, about 6 miles east of the Thousand Palms Canyon. A pack trail leads to it. The spring takes its name from a mining company that at one time operated a 2-stamp mill there, using the water from the spring for the purpose.

224. *Piñon Pine Well, Riverside County (O-8).*—This well is about 25 miles northeast of Indio, on the new wagon road to Twenty-nine Palms Springs. The air-line distance is perhaps 15 miles. A mining company has erected a 2-stamp mill here and sunk a well from which a good supply of pure water is derived. The well receives its name from the piñon trees around it.

About 3 miles southeast of this camp, away from the main road or trails, are the Red Tanks, where water collects in a bowl in the granite. The writer has no information as to the permanency of this supply or the quality of the water.

225. *Stirrup Tanks, Riverside County (O-8).*—These tanks or natural rock basins are in the granite of an unnamed range, the one next west of Pinto Mountain. They are on the road from Indio to Twenty-nine Palms Springs, and have not been known to be dry during the last ten years, a period of exceptionally low rainfall in the Southwest. The water is of excellent quality. Travelers may learn the route to them at Indio or Twenty-nine Palms Springs.

226. *Washington Tank, Riverside County (O-8).*—This tank is in the San Bernardino Range, about 16 miles west of Cottonwood Springs (No. 227). The water is said to be of excellent quality and a fair supply may be depended on in ordinary seasons. Travelers will have to make local inquiries in order to find the tank.

227. *Cottonwood Springs, Riverside County (O-9).*—These springs are in Cottonwood Pass, 26 miles northeast from Mecca, on the main road to Dale. They are 14 miles northeast of Shaver Well (No. 241). The springs are readily found, their site being marked by the ruins of a concrete reservoir and by the corral, water troughs, and engine house of the Iron Chief Mining Company. The water, which is of good quality, is usually flowing, but more or less débris often obscures or obstructs the springs during the winter rains, so that the first travelers in the early spring are obliged to clean them out. About 3½ miles east, on a trail on the south slope of Cottonwood Mountains, are many large native palms growing in the canyons, where water is always standing exposed or close to the surface. At the southwest end of the Providence Range, 75 miles northward, are other springs of the same name (No. 162).

228. *Iron Chief Well, Riverside County (O-9).*—This well is in the northeast end of Eagle Mountains. It is reached by a side road from Cottonwood Springs, which lies about 8 miles southwest. The water is good.

229. *Lightfoot or Boulder Well, Riverside County (O-10).*—About 6 miles west of Palen Dry Lake a well has been sunk by Lightfoot Brothers, who have erected over it a windmill which is visible for a number of miles. This windmill and pump are usually out of order.

230. *Palen Wells, Riverside County* (O-10).—There are two old wells, 14 feet deep, at the southwest edge of Palen Dry Lake, a few miles east of the Lightfoot well. The water is brackish but potable. In 1905 it was reported that Mr. H. R. Adams drilled a new well near the old ones.

231. *Packard Well, Riverside County* (O-11).—The Packard Well is about 21 miles northeast of the Lightfoot Well, in the Palen Mountains. It is near the bottom of a small arroyo and is surrounded by mesquite trees. The well is not covered, so that the water is often contaminated by the bodies of desert animals. A ridge of limestone south of the well serves as a landmark.

232. *Brown's Well, Riverside County* (O-11).—This is a drilled well, 300 feet deep, near the junction of the roads from Mecca and from Danby Lake to Ehrenberg, Ariz. Its location is plainly determinable from the road, as there are two adobe buildings and a corral near it. It is owned by Floyd Brown, who lives there. No charge is made for water.

234. *Indian Well, Riverside County* (P-7).—This well is situated among the sand hills about 6 miles west of Indio, at an elevation of 97 feet (U. S. Geological Survey). It is on the road along the southwest side of the Coachella Valley, connecting Palm Springs with the settlements about Indio, and is just north of a rough spur of the Santa Rosa Range that extends northwestward for some miles into the desert. The well is 30 or 40 feet deep and is an open shaft in which a pump has been placed.

235. *Indio, Riverside County* (P-7).—Indio (15 feet below sea level), the end of a division on the Southern Pacific Railroad, is well known as a health resort and as the shipping point for a thriving agricultural district. The railroad company has wells here and a pumping plant for supplying the settlement and the road. In this vicinity there are also many other pumping plants that supply water of the finest quality in considerable volume for irrigation and other purposes.

236. *Coachella pumping plant, Riverside County* (P-7).—The Southern Pacific Railroad Company has installed a pumping plant at Coachella station, which is between Indio and Mecca. The water comes from the deep gravels that underlie the Coachella Valley. Throughout this valley from Indio to Mecca there has been rapid development since 1900 by the utilization of underground waters. There are now several hundred wells bored, most of them yielding artesian water of the finest quality. Their use is rapidly transforming this part of the desert into a rich agricultural district.

237. *Toro Springs, Riverside County* (P-7).—This group of springs and the one next to be described are two among a number of ciénagas in which the artesian waters under this part of the desert rise to the

surface. Indian settlements are grouped about these watering places, which were formerly of much importance, but are now less valuable because of the numerous artesian wells in the vicinity. Toro is about 9 miles south of Indio, at 111 feet below sea level, on the old wagon road that follows the western edge of the Colorado Desert.

238. *Alamo Bonito Springs, Riverside County* (P-7).—These springs, which are similar to those at Toro, just described, are about 5 miles southwest of Mecca, at 186 feet below sea level (U. S. Geological Survey). The name is Spanish, and signifies “good poplar.” Cottonwood trees are abundant in this vicinity.

239. *Agua Dulce, Riverside County* (P-8).—This is a cluster of strong springs of “sweet water,” as the Spanish name indicates, on the west side of the Colorado Desert, about 7 miles south of Mecca, on the road from Mecca to Seventeen Palms Springs (No. 254). They lie 183 feet below sea level (U. S. Geological Survey). The springs are due to the up-welling of artesian waters that are imperfectly confined by the clay strata underlying this part of the Colorado Desert. There are a number of springs in the group, and several Indian habitations are scattered around them. The flow is constant, so that water may be obtained here at any time. Originally they were of much importance, but the settlement of this particular region and the boring of artesian wells in the vicinity have lessened the value of the natural springs.

240. *Mecca, Riverside County* (P-8).—Two artesian wells bored at Mecca station by the Southern Pacific Railroad Company were among the first successful wells in the Coachella Valley. They have a strong flow, and besides furnishing a supply for the locomotives and tank cars of the Southern Pacific system, are utilized by some of the settlers in the village.

241. *Shaver Well, Riverside County* (P-8).—This well is about 12 miles northeast of Mecca, on the road to Dale. It is at the upper end of a box canyon, within sight of the road, and is easily found. It is about 30 feet deep, well timbered and protected. There is a rope, bucket, and pulley, so that it is easy to get the water, which is of superior quality. The well is surrounded by mesquite shrubs and palo verde. Three miles southwest of Shaver Well, in a canyon that opens to the south, over a ridge, half a mile south of the county road, is water surrounded by a few burnt palms, and about 2 miles farther to the southeast, up another canyon in a little side glen, is a beautiful clump of palms with a spring of pure water beneath them.

242. *Dos Palmas, Riverside County* (P-8).—Dos Palmas is a well-known stopping place on the old San Bernardino and Yuma road, about 6 miles east of new Salton station, on the Southern Pacific Railroad, near the clearly defined old beach line that stands 40 feet above sea level in the Colorado Desert. The position of the springs

is marked by two large desert palms, which give the name to the place. The springs yield a large quantity of tepid and slightly salty but drinkable water, the first to be found on this old road southeast of Mecca, which is about 16 miles distant. The next water to the southeast is at Frinks Springs (No. 258), 12 miles away. Since the building of the Southern Pacific Railroad the old wagon road is only occasionally used.

The Orocopia Mining Company has established a pumping plant at the springs, by means of which the water is pumped to its mines, 12 miles farther north.

243. *Canyon Springs, Riverside County* (P-9).—These springs, which yield a small supply of poor water, are in a side canyon north of the road that runs from Mecca via Salton to Palen Dry Lake. South of the springs the road branches, one fork crossing the pass in the Chuckwalla Mountains to the north and the other fork turning southeastward across the divide to the Ironwood Mountains. Water is again found on the northern road, near the southwest edge of Palen Dry Lake, about 25 miles away.

244. *Mill Camp, Riverside County* (P-10).—This is a mining camp about 30 miles east of Salton, on the Ehrenberg road. There are buildings at the springs, which furnish plenty of good water.

245. *Aztec Well, Riverside County* (P-10).—This well is about 9 miles east of Mill Camp on the road to Ehrenberg. There is an abundance of good water.

246. *Granite Tanks, Riverside County* (P-10).—These tanks or natural basins in the granite are at the northeastern edge of the Chuckwalla Mountains. The water, which is of fine quality, rises at the foot of a granite outcrop in a little ciénaga about 25 feet across, and flows over the surface for a short distance before it sinks into the sand. More water could probably be procured here by development. The tanks are on the road from Mecca station to the Ironwood Mountains, about 6 miles southwest of Long Tanks, another watering place of similar character, and about 10 miles south of the Palen Wells (No. 230). Lightfoot or Boulder Well (No. 229) is about 14 miles northward by road. The first water to be obtained to the east is at McCoy Spring (No. 249), in the Ironwood Mountains, 25 miles distant.

247. *Corn Springs, Riverside County* (P-10).—These springs are situated on the east side of the Chuckwalla Mountains, about 6 miles south of Granite Tanks. The water, which amounts to 8 or 10 miner's inches, rises in a local ciénaga. It is probable that careful development would increase the flow and furnish water enough for the irrigation of a number of acres.

248. *Chuckwalla Spring, Riverside County* (P-10).—This spring is on the south road from Mecca to Palo Verde, near the southwest edge of the Chuckwalla Mountains, in a pass that separates this range and the Chocolate Mountains. The water is of excellent quality and is fairly abundant.

249. *McCoy Spring, Riverside County* (P-11).—This spring is on the west edge of the McCoy or Ironwood Mountains, about 25 miles east of Granite Tanks, on the road from Mecca to Ehrenberg. The water is excellent, but the supply is small, the springs yielding only about 4 barrels a day.

250. *Springs (no name), Riverside County* (P-12).—These springs are at the east edge and near the north end of the Palo Verde Mountains, about 7 miles northwest of the town of Palo Verde, and are used by stockmen.

251. *Spring (no name), Riverside County* (P-12).—There is reported to be a good spring on the old Ehrenberg road to Mecca, about 5 miles northwest of Colorado River, but the writer has no further information concerning it.

252. *Borego Spring, San Diego County* (Q-7).—Borego Spring is on the west bank of the broad Borego Wash, at an elevation of 452 feet (U. S. Geological Survey). Its distance by wagon road from Julian is about 33 miles. The water of this spring, although somewhat alkaline, is entirely usable. Mesquite trees grow near the spring and in the valley, and salt grass, willow, and rushes are abundant. An old cabin stands on the bank about 50 feet from the spring and serves to mark its position.

From Borego Spring the wagon road runs down the Borego Wash about $2\frac{1}{2}$ miles to its junction with the San Felipe Wash, which comes in from the southwest. Just beyond the junction of the two washes the road forks, one branch continuing down the San Felipe, the other turning to the left and crossing the mesa and the clay hills toward Seventeen Palms Springs (No. 254). Neither road is much used, and after rains both are dim and difficult to follow.

253. *Clark Well, San Diego County* (Q-7).—This well is about three-fourths of a mile north of the northeast end of Clark Dry Lake, at an elevation of 555 feet (U. S. Geological Survey). Trails lead to it from Rock House Canyon and from Coyote Creek valley, and a little-used wagon road connects near Borego Spring with the road from Seventeen Palms Springs to Julian. The well can be easily found from its position north of the dry lake. The water is good.

254. *Seventeen Palms Springs, San Diego County* (Q-7).—Seventeen Palms Springs lie at an elevation of 410 feet (U. S. Geological Survey), near the junction of three washes in the clay hills, south of the Santa Rosa Mountains. At present only eight or nine palm trees stand near them, the remainder of the seventeen, from which the

springs were named, having been destroyed by fire. The springs are about 12 miles by wagon road east from Borego Spring, or 45 miles from Julian, but the road is little used, is dim, and may be difficult to follow, particularly after the winter rains. Broken clay hills and deep washes surround the springs. Grass and wood in small quantities may be found near them. When they are kept open the water is fairly good, but it becomes bitter and bad by neglect and disuse. The soil is impregnated with alkaline salts.

255. *Soda Springs, Imperial County* (Q-8).—Soda Springs are located about 15 miles southeast of Fish Springs (No. 256), on the road from Mecca down the west side of the Colorado Desert. The water is so salty as to be scarcely potable and near by are other springs whose water is entirely undrinkable. Soda Springs are at the base of a low barren knoll, one-half or three-fourths of a mile south of Clay Point, marked by a government bench mark, around which the road turns on the way from Mecca to Seventeen Palms Springs. The road from Clay Point south toward Harper Well (No. 264) is very little traveled and is difficult to find.

256. *Fish Springs, Imperial County* (Q-8).—Fish Springs (230 feet below sea level), now (1908) submerged to a depth of about 25 feet beneath Salton sea, are a group of strong natural springs whose aggregate yield is several miner's inches. The waters are tepid and slightly saline, but of sufficiently good quality to be used by men or animals without injurious effects. Before their submergence these springs were especially important to travelers because they are at the southernmost point at which water of fair quality can be procured in abundance along the west side of the desert until Harper (Mesquite) Well is reached. They will emerge again as the lake shrinks by evaporation, and when the lake water has become too saline for use they will again become important. Their position is indicated by a prominent rocky point which stands out in the desert about 1 mile east of the base of the Santa Rosa Mountains, and which is conspicuous not only because of its position but because of the distinct water line that encircles it 10 or 15 feet below its summit. This point is about 2 miles northeast of the springs.

257. *Figtree John's Springs, Riverside County* (Q-8).—This small group of springs is about 12 miles south of Mecca station, and about 3 miles southeast of Agua Dulce, at 197 feet below sea level (U. S. Geological Survey). About the springs are clustered the huts of the family of Figtree John, one of the Coahuila Indians. The water is tepid but is abundant and of excellent quality. The position of the springs is marked by a number of large fig trees. They are about 1 mile east of north of a rocky outlier of the Santa Rosa Mountains, which also serves as a landmark for the location of Fish Springs, about 3 miles farther south. Figtree John's Springs

were submerged during the winter of 1906-7 by the rising waters of Salton Sea, but will reappear as the water subsides.

258. *Frinks Springs, Imperial County* (Q-9).—These springs are about 6 miles northwest of Frinks station, on the Southern Pacific Railroad. They are on one of the old wagon roads from San Bernardino to Yuma, near the old beach line that stands about 40 feet above sea level in the Colorado Desert. The water is of good quality and in fair quantity.

259. *Spring (no name), Riverside County* (Q-11).—This spring is at the south base of a western outlier of the Palo Verde Mountains, about 6 miles northeast of the Chuckwalla settlement, on the road thence to Ehrenberg, Ariz. The spring is near the road, has long been known and used, and is readily found. The quality of the water is good and the supply is fair.

260. *Mule Springs, Riverside County* (Q-11).—These springs are in the main pass on the west side of the Palo Verde Mountains, on the road from Mecca to Palo Verde, by way of Chuckwalla, and about 8 miles northeast of the Chuckwalla settlement, which itself lies at the east base of the Chuckwalla Mountains. The position of the springs is marked by a grove of timber. The water is good and the supply abundant.

261. *Vallecito Springs, San Diego County* (S-7).—Vallecito Springs are located in the valley of Vallecito Creek, about 33 miles east of Julian, on the wagon road to Carrizo station (No. 270), at an elevation of about 1,600 feet. The old adobe stage station, in use when this road was a part of one of the transcontinental stage routes, still stands and is in fairly good condition. A watering trough stands near the building, and there are mesquite and cottonwood trees in the vicinity. The quality of the water is fair.

262. *Hanna Well, San Diego County* (R-7).—This well is at the base of the north slope of Black or Fish Creek Mountain, 15 or 18 miles southeast of Borego Spring, and 10 or 12 miles southwest of Harper (or Mesquite) Well (No. 264). It is not on a main road, but is near the mouth of a canyon heading in a pass that leads to the valley of Carrizo Creek. The water is good.

263. *McCain Springs, Imperial County* (R-8).—McCain Springs are about 5 miles somewhat east of south of Clay Point, mentioned in the description of Soda Springs (No. 255). They are in the center of a broad wash, locally called the Arroyo Grande, and are marked by three large sand dunes from a quarter to half a mile southwest. The surrounding country is traversed by numerous gulches from 6 to 20 feet in depth and often difficult to cross. The springs, which are well below sea level, have built up a small mound in the bed of the wash. The water appears to be charged with carbonic acid gas and is fairly palatable.

In March, 1901, excellent water was found by digging a hole in the sand near the right bank of the wash, about 430 feet upstream from the springs. Firewood is scarce in the vicinity, but grass for stock may be found some distance away. These springs are about 9 miles southeast from Seventeen Palms Springs.

264. *Harper (or Mesquite) Well, Imperial County (R-8).*—At the junction of Carrizo and San Felipe creeks an attempt was made a few years ago to develop oil. No oil was found, but at a depth of about 300 feet a flow of good water was obtained. The site of the well is plainly marked by the derrick, which can be seen for a long distance across the desert. There is an abundance of mesquite timber in the vicinity.

265. *Kane Spring, Imperial County (R-8).*—This spring is 6 miles east of Harper Well, on top of a low knoll. It is surrounded by cane, salt grass, and arrow weed. The water is full of soda and is very poor, being hardly fit for use.

266. *Agua Caliente Springs, San Diego County (S-7).*—About $3\frac{3}{4}$ miles eastward from Vallecito Springs and about three-fourths of a mile southeast of the main wagon road between Julian and Carrizo station there are several springs in a natural amphitheater comprising an area of about 50 acres. The water is tepid and is impregnated with sulphur, but is not unpleasant to the taste. The combined flow of the springs makes a rather large stream. Grass and wood are scarce.

267. *Mountain Palm Springs, San Diego County (S-7).*—These springs are at the foot of a high, broken rocky ridge and are several miles south of the main wagon road across the Sierra Madre, but can be easily reached by a side road that was made a few years ago. The water is cool and fairly good. Wild palms and other vegetation make the vicinity inviting.

268. *Palm Springs, San Diego County (S-7).*—There are several Palm Springs in San Diego County, but those here referred to are about 9 miles east of Vallecito Springs, just north of the line between sections 25 and 36. The palms that gave the springs their name were destroyed long ago, but there are several mesquite trees near by. The springs are situated under a clay bank, and digging is sometimes necessary in order to obtain water. The water has a temperature of about 60° and is somewhat sulphurous.

269. *Mason ranch, San Diego County (S-7).*—Mason ranch is on the road from Carrizo Creek to Sentenac and Agua Caliente (Warner's ranch). This is the principal road through this part of the desert, and may be easily followed and identified. At the ranch, which will be recognized at once by travelers over the road, an excellent supply of water has been developed.

270. *Carrizo station, San Diego County (S-8).*—Carrizo station (elevation, 450 feet) is near the left bank of Carrizo Creek wash, about 9 miles east of Palm Springs, on the main wagon road from Julian to the Imperial Valley. There are a number of springs near the station, and two of them furnish fairly good water. There is also a rather large tule swamp around the station, from which a strong stream of alkaline water flows. Rough clay hills of late Tertiary age, showing typical badland erosional forms, are prominent features of this region. Carrizo was originally a stage station on one of the old overland lines, but the adobe buildings are now in a dilapidated condition, their ruin having been completed by the earthquake of February, 1892.

271. *Coyote Well, Imperial County (S-8).*—Coyote well is about 375 feet above sea level, on the main wagon road from Mountain Springs (No. 274) to Silsbee, the southernmost of the wagon roads that cross the Sierra Madre from the Imperial Valley to San Diego. The old Coyote well was a mere pit curbed up with planks. A new well, standing about 100 feet from the old one, was fitted up with a pump, but this has been broken recently. The water is rather alkaline, but improves after the well has been used for some time.

272. *Yuha Springs, Imperial County (T-8).*—Yuha Springs are located in a wash near the corner of sections 5, 6, 7, and 8, about 5 miles southeast of Coyote well and a mile southwest of the derrick at the Yuha oil well. The regular wagon road from Campo to Silsbee crosses the desert about 2 miles north of the springs. The water is impregnated with alkaline matter, but when used continuously is not unpleasant or harmful. In 1905 there was a trough and pump at the springs.

273. *Sunset Springs, Imperial County (S-10).*—These springs, which have long been known, are about 13 miles south of east from Brawley, below the old beach which is so prominent a feature about the borders of the Colorado Desert. It is reported that the paths of animals using the springs led to their discovery. They are of less importance now than before the reclamation of so large a part of the Imperial Valley by the introduction of Colorado River waters.

274. *Mountain Springs, San Diego County (T-7).*—Mountain Springs are about 9 miles by wagon road from Jacumba Springs (No. 275) and 33 miles from Campo, at an elevation of about 2,500 feet. Forty years ago there was a stage station here on the Butterfield stage line that ran from San Diego to Yuma. The ruins of the old stone corral and buildings are still visible. The water issues from the side of a rocky ravine and a portion of it is carried in an inch pipe about 200 feet long to a trough beside the road. Its quality is excellent.

From Mountain Springs the wagon road leading to the desert runs through a rocky gorge in which water can be found a portion of the year. From the mouth of the gorge the surface slopes gently eastward to Coyote Well, 12 miles from Mountain Springs and 45 miles from Campo.

275. *Jacumba Springs, San Diego County (T-7).*—Jacumba Springs are about 24 miles east of Campo, near the quarter-section corner between sections 7 and 8, T. 18 S., R. 8 E., and about $\frac{1}{4}$ mile north of Monument No. 233 of the boundary line between the United States and Mexico, at an elevation of about 2,825 feet. They are on the west side of a long, open valley whose outlet is to the northeast, through a deep, narrow gorge. The greater part of this valley, which is the head of the Carrizo Creek drainage system, is in Mexico. The springs include one of cold water and several that yield waters with temperatures ranging from 86° to 98° F. These thermal waters are regarded as medicinal, and a bath house and other accommodations are provided for travelers.

NEVADA.

276. *Palmetto, Esmeralda County (A-3).*—This is one of the oldest settlements in the northern portion of the Palmetto Range, and is an outfitting point for prospectors in that region. It is reached by a road from Alvord station, on the Southern Pacific Railroad, by way of Deep Springs and Oasis, and is well supplied with water from both wells and springs.

277. *Indian Spring, Esmeralda County (A-3).*—This spring is about 6 miles east of the Palmetto Mountains and about the same distance northwest of Barrel Springs (No. 278). Parties prospecting in the region can obtain full directions for reaching it at Palmetto or at Lida.

278. *Barrel Springs, Esmeralda County (A-3).*—These springs are in the eastern edge of the Palmetto Mountains, about 1 mile northeast of Lida and about 5 miles southeast of Indian Spring. As the country is comparatively well settled, directions for finding the springs can be had at Lida or at Palmetto.

279. *Gold Mountain, Esmeralda County (A-4).*—There is a well at this point, 1 mile east of Tokop and 20 miles southeast of Lida, that yields a small supply of good water. There is another well $1\frac{1}{4}$ miles northeast of this one, across two small ridges. The water is good.

280. *Old Camp, Esmeralda County (B-4).*—This is a small spring near the summit of Gold Mountain, having a fair supply of good water.

281. *Willow Spring, Esmeralda County* (B-4).—This is a small spring on the east side of Gold Mountain, near the summit, $1\frac{1}{4}$ miles southeast of Old Camp. The supply is scanty, but the water is good. There is also a spring of the same name (No. 287) about 20 miles southeast, in the Grapevine Range.

282. *Thorp Mill, Nye County* (B-5).—This site is marked by an old stamp mill. It was originally a stage station and post-office on the road from Goldfield to Bullfrog, but the station has been abandoned and the post-office moved to Bonnie Claire station, $2\frac{1}{2}$ miles farther north. The road between Goldfield and Bullfrog passes the mill. A well and a spring supply an abundance of good water here.

283. *Bonnie Claire station, Nye County* (B-5).—This station is at the northwest edge of Sarcobatus Flat, about 35 miles south of Goldfield, on the stage road from Goldfield to Bullfrog, at an elevation of 3,973 feet (U. S. Geological Survey). Several wells that have been sunk 12 feet into the playa deposits yield a good supply of slightly brackish water. This station has taken the place of the old Thorp Mill and Summerville stations, about 2 miles farther south and now abandoned. Thorp post-office, originally located at Thorp Mill, has been moved to Bonnie Claire station.

284. *Tonopah Well, Nye County* (B-5).—This well is about $7\frac{1}{2}$ miles southeast of Bonnie Claire station, at the southwest edge of Sarcobatus Flat. A well about 20 feet deep has been sunk in the playa deposits, but the water is poor.

285. *Seattle Well, Nye County* (B-5).—This well is on the road from Goldfield to Bullfrog, about $1\frac{1}{4}$ miles south of the Tonopah Well and about $1\frac{1}{2}$ miles southwest of a dry lake bed. It is about 20 feet deep, but has no pump or windlass. The water is abundant and good.

286. *Farmer station, Nye County* (B-5).—Farmer station is a half-way house between Goldfield and Bullfrog, on the old private road of the automobile company. It is on the east side of Sarcobatus Flat, about 5 miles east of Bonnie Claire station. Private conveyances use the road by way of Bonnie Claire station, as they can find no water on the old automobile road until they reach the head of Amargosa River.

287. *Willow Spring, Nye County* (C-4).—This spring is about 4 miles a little east of north of the highest peak in the Grapevine Range, known as Grapevine Peak. It is on the north side of a high spur at the end of a wood road. There is another Willow Spring (No. 281) about 20 miles northwest, in Gold Mountain.

288. *Brier Spring, Nye County* (C-5).—This spring is about 3 miles south of east of Wahguyhe Peak, on the northwest slope of a big spur of the Grapevine Range, about 1 mile northwest of Mexican Camp No. 289, and 1 mile north of the Alkali Spring mentioned

below. There is a plentiful supply of good water. There are also springs in the first canyon due east of Wahguyhe Peak, and about 2 miles a little south of east of the peak. The water is abundant and good.

289. *Mexican Camp and Alkali Spring, Nye County (C-5)*.—This is a wood camp in the Grapevine Range in the first canyon south of Wahguyhe Peak that drains into the Amargosa Desert, at the end of the wagon road about $1\frac{1}{2}$ miles east of the divide. It is about 13 miles north of west of Bullfrog, and $2\frac{1}{2}$ miles northeast of Nevada-California boundary post No. 91. The spring is small, with very little water. There is a trail from Mexican Camp to Death Valley by way of Titus Canyon, and on this trail about $1\frac{3}{4}$ miles southwest of the camp, one-fourth mile west of the divide on the north side of the trail, there is a small spring called Alkali Spring by some. The supply of water is small and its quality is poor.

290. *McDonald Spring, Nye County (C-5)*.—This spring is on the east slope of the Grapevine Range, 10 miles a little north of west of Bullfrog, about $2\frac{1}{2}$ miles north of Cave Rock Spring (No. 291), and 1 mile south of a wood road on the south side of a small butte. The supply of water is small.

291. *Cave Rock Spring, Nye County (C-5)*.—This spring is on the east slope of the Grapevine Range, about 10 miles a little south of west of Bullfrog, and 2 miles south of east of Nevada-California boundary post No. 92. It is well up the slope above the wash and accessible to wagons. The flow is about 4 barrels per day.

292. *Currie Wells, Nye County (C-5)*.—This watering place is 10 miles northwest of Bullfrog, on the road from Goldfield, at an elevation of 4,401 feet (U. S. Geological Survey). Water is obtained from three wells, 10, 12, and 14 feet deep, yielding about 200 barrels of excellent water daily. There is a stage station here, at which meals and forage for animals can be obtained.

293. *Mud Spring, Nye County (C-5)*.—These springs are about 10 miles north of Bullfrog and about 4 miles northeast of Currie Wells, on the south edge of Sarcobatus Flat. They have been extensively used by freighters and their location is clearly marked by camp débris. There is a fair supply of good water.

294. *Oasis Valley, Nye County (C-6)*.—This is the name given to the valley in which Amargosa River rises. In it there are nearly 100 springs, which constitute the source of the river. These springs are scattered along the valley for about 6 miles and yield thermal as well as cold waters. Among them are the Oasis Springs, from which water is piped to the town of Bullfrog. This valley should not be confused with Oasis, a settlement in the southeastern corner of Mono County, Cal.

295. *Topopah Spring, Nye County* (C-7).—This is also called Black Rock Spring. It is about 15 miles northwest of Cane Spring (No. 298), high up on the south slope of Shoshone Mountain, on the east side of a basin bounded on the west by low "calico" hills. The supply of water is very meager.

296. *Railroad Tank, Nye County* (C-8).—This tank, or natural basin, is in the open valley about 20 miles due south of Oak Springs Butte, one-half mile west of White Mud Flat (a dry lake), and 13 miles north from Cane Spring (No. 298). The water is very alkaline, and the tank is usually dry in August.

297. *Rose's Well, Nye County* (D-6).—This well is near a station on the Las Vegas and Tonopah Railroad, being about half a mile west of the railroad, on the old stage road from Fairbanks Ranch to Bullfrog. The well is 210 feet deep and yields about 100 barrels per day of good water.

298. *Cane Spring, Nye County* (D-8).—This spring is on the old emigrant road from Salt Lake to Los Angeles, about 13 miles south of Railroad Tank, about 45 miles south of east from Bullfrog, and 25 miles northeast of Fairbanks Ranch. It is 30 miles by road northwest of Indian Springs station, on the Las Vegas and Tonopah Railroad. The water is good and the supply is about 25 barrels per day.

299. *Miller Well, No. 1, Nye County* (E-6).—This is a well dug by Mr. Miller, on the stage and automobile road from Las Vegas to Bullfrog. It is about 8 miles northwest of the Fairbanks Ranch, at an elevation of 2,555 feet (U. S. Geological Survey). The well is about 200 feet deep, and will supply 200 barrels per day. There is no rope, as the well has not been used since 1905.

300. *Fairbanks Ranch, Nye County* (E-7).—This is a well-known ranch and stopping place for travelers on the roads leading from Barnwell to Ivanpah, Cal., and from Roach and Jean, Nev., northward by way of Manse. The ranch is near the north end of Ash Meadows, at the southeastern edge of what is known as the Amargosa Desert. It has been occupied and cultivated for a number of years, and is supplied with an abundance of water from springs that suffice to irrigate a large tract. Both grain and provisions may be obtained here by travelers.

Roads lead from Fairbanks Ranch southeastward to Pahrump (35 miles away) and to Manse (40 miles away). There are no regular watering places between Fairbanks Ranch and Pahrump. Other roads toward the northeast and north connect with the main Las Vegas-Bullfrog road at Miller Well No. 2, and still other roads lead westward to Furnace Creek and the north end of Death Valley. Specific details as to all these roads can be had at the ranch.

301. *Miller Well No. 2, Nye County* (E-7).—This well, now abandoned, was dug by Mr. Miller on the stage and automobile road from

Las Vegas to Bullfrog and stands at an elevation of 2,490 feet. (U. S. Geological Survey.) It is about 6 miles northeast of Fairbanks ranch and about the same distance southwest of Amargosa station, on the Las Vegas and Tonopah Railroad. There is a building at the well, and until recently water has been sold to travelers. The well is about 70 feet deep and can supply 100 barrels per day. The water is brackish, and there is no rope at the well, which has not been in use since 1905.

302. *Johnnie, Nye County* (E-8).—This mining settlement has come into existence since 1902. It is about 18 miles west of north from Pahrump and about 12 miles southeast of Miller Well No. 2. Water is piped to the town from Horseshutem Spring, about 4 miles to the east.

303. *Kevichup Spring, Nye County* (E-8).—This spring is near the Johnnie mine, 5 or 6 miles northeast of the town of Johnnie. The water is used for the mining camp, and is said to be of excellent quality.

304. *Hornet Springs, Lincoln County* (E-9).—These springs are on the northeast slope of Spring Mountain, about 7 miles south of Elderberry and about 20 miles northeast of Manse, on a road from Manse to Indian Springs (No. 305). They yield a large supply of water of excellent quality.

305. *Indian Springs, Lincoln County* (E-9).—These springs are about 20 miles northwest of Corn Creek Spring, 35 miles east of Miller Well No. 2, and 45 miles from Las Vegas. They are more than 5 feet deep and yield an abundant supply of water, which issues from limestone. This is one of the important camping places on the stage and automobile road from Las Vegas to Bullfrog.

306. *Corn Creek Spring, Lincoln County* (E-10).—This spring forms another stopping place on the road from Las Vegas to Bullfrog. It yields from 1 to 2 miner's inches of excellent water.

307. *Pahrump, Nye County* (F-8).—Pahrump, one of the oldest settlements in the southern portion of Nevada, is about 7 miles northwest of Manse, on the road to Fairbanks ranch. It is a large ranch, in whose cultivation a number of Indians are employed. Here orchards, vineyards, and extensive fields of alfalfa flourish, and the water used in irrigation is supplied by a number of large, deep-seated warm springs, similar to those at Manse. Travelers can obtain hay and grain here.

308. *Manse Springs, Nye County* (F-8).—The springs at Manse have been known for years to travelers going northward from points in southern Nevada, and the place has long been the principal stopping point along this route. By the use of the water which the springs yield, this portion of the desert has been converted into a veritable oasis, and the 500 or 600 acres of alfalfa, orchards, and

vineyards show the capabilities of the desert soil when water can be applied to it in sufficient quantity.

The springs are over 20 feet in diameter and from 5 to 6 feet deep. The bottom is of white sand, and warm water boils up through this in large volume. These important springs and those of similar character at Saratoga Springs, Resting Springs, and Indian Springs, all occur along a line that runs nearly northeast and southwest. All of them are remarkable for the volume and purity of the water they yield.

311. *Mountain Spring, Lincoln County* (F-9).—This spring is about 4 miles, air line, southwest of Wilson's ranch, and on the other (the western) slope of Spring Mountain. It is about 8 miles northwest of Crystal Springs (No. 316), and is but little below the highest point on the road from Las Vegas westward to the Pahrump Valley. It is close by the roadside and its position is well marked. The supply of water is ample.

There are many springs in Spring Mountain, many of which are well known locally and may be reached by roads or trails from Pahrump, Manse, Las Vegas, and points on the San Pedro, Los Angeles and Salt Lake, and Las Vegas and Tonopah railroads.

312. *Tule Springs, Lincoln County* (F-10).—These springs are about 12 miles northwest of Las Vegas, on the road from Las Vegas to Bullfrog. The waters rise along the edge of a dry lake in the northwestern extension of Las Vegas Valley. They are the first springs to be found along this road beyond Las Vegas.

313. *Vegas Springs, Lincoln County* (F-10).—These are warm springs about 2 miles west of the city of Las Vegas. They yield a supply that is used locally for irrigation. Frémont stopped here May 3, 1844, and speaks of the waters as "two narrow streams of clear water, 4 or 5 feet deep, with a quick current, from two singularly large springs." The water has a pleasant taste, but is rather too warm to be agreeable, the temperatures being respectively 71° and 73° in the two springs.

314. *Mesquite Springs, Lincoln County* (F-11).—These springs are about 10 miles southeast of Las Vegas, on the south road leading thence to Callville. The water supply is reported to be good, and the position of the springs is clearly marked by camp rubbish. Mesquite Wells (No. 320) are in Mesquite Dry Lake, about 35 miles southwest, on the western edge of the State.

315. *Stump Spring, Lincoln County* (G-9).—This spring is about halfway between Sandy and Manse, on the old stage road from Ivanpah to Manse. It is protected by curbing, and the water must be drawn by a bucket. Roads from Stump Spring lead westward to Resting Springs, and eastward to Las Vegas, both by way of Crystal Springs (No. 316) and by way of Wilson's ranch (No. 317).

316. *Crystal Springs, Lincoln County* (G-9).—These springs are in a pass between two ranges that have only local names, about 8 miles southeast of Wilson's ranch. They are plainly marked, as they have been used for many years by the settlers.

317. *Wilson's Spring, Lincoln County* (G-10).—This spring is on the well-known Wilson ranch, about 20 miles south of west from Las Vegas, on the road from Las Vegas to Stump Spring. The water is used for irrigating the ranch.

318. *Cottonwood Springs, Lincoln County* (G-10).—These springs are 4 miles southeast of Wilson's ranch and about 18 or 20 miles southwest of Las Vegas, on the old wagon road from Las Vegas to Good Springs or Jean station. The water is good and its amount great enough to irrigate a small ranch.

319. *Sandy, Lincoln County* (H-9).—Sandy, a mining settlement and post-office, is on the old stage road from Ivanpah to Manse. It is about 1 mile north of Mesquite Dry Lake and about 16 miles west of Good Springs or Jean station, on the Salt Lake Railroad. Water is to be had at several near-by points east and south, but on the road running northward the nearest water is found at Stump Spring, about 18 miles away. There are stores in the settlement, where supplies may be obtained.

320. *Mesquite Wells, Lincoln County* (H-9).—These wells are in a clump of mesquite trees in Mesquite Dry Lake, about 3 miles south of Sandy post-office, on the stage road from Ivanpah to Manse. They are protected by curbing, and the water stands so near to the surface that it is easily drawn up in a bucket. The quantity is sufficient and the quality fair.

321. *New England Springs, Lincoln County* (H-9).—These springs are between Jean and Sandy, on the road connecting the two points. At the springs a branch road turns northward to Crystal Springs and Wilson's. The flow of the springs is estimated at 1 or 2 miner's inches.

322. *Good Springs, Lincoln County* (H-10).—These springs are on the road to Sandy post-office, about 6 miles west of Jean station. There are large mines in operation near by, and a settlement has grown up around them. The supply of water is large and its quality is indicated by the name.

323. *Piute Springs, Lincoln County* (I-11).—These springs are about 13 or 14 miles from Barnwell station (Manvel post-office), just east of the California-Nevada line, in the Piute Range. The main road from Barnwell to Searchlight runs about 3 miles north of them, but there is a dim trail between these places that passes the springs. Their exact location can best be ascertained by inquiries at the railroad station. The water issues from the granite that forms the axis of this range, and is pure and sweet. Other Piute Springs (No. 149) lie in Piute Pass, about 20 miles south.

INDEX.

A.	Page.		Page.
Agua Caliente Springs, Cal., description of.	85	Canteens, need for	24
Agua Dulce Springs, Cal., description of...	80	Canyon Springs, Riverside Co., Cal., de-	
Alamo Bonita Springs, Cal., description of.	80	scription of.....	81
Alamo River, description of.....	15	Canyon Springs, San Bernardino Co., Cal.,	
Alkali Spring, Nev., description of.....	89	description of	60
Alverson, C. S., work of	8	Carrijo, Cal., springs at.....	86
Amargosa River, description of	9-10, 14	Cave Rock Springs, Nev., description of ...	89
water of	9-10	Cave Springs, Cal., description of	47
Amboy-Dale route, description of	28	Chapman, R. H., work of	8
Arab Spring, Cal., description of	37	China ranch, Cal., road to.....	40-41
Argus Mountains, spring in	39	springs at.....	41
Arrowweed, water near	20	China Well, Cal., description of.....	42
Arsenic springs, nonexistence of.....	15, 48-49	Chinese pusley, water near.....	20
Artesian water, development of.....	29-30	Chuckwalla Spring, Cal., description of....	82
Aztec Well, Cal., description of.....	81	City Wells, Cal., description of	51
		Clark Well, Cal., description of	82
		Clay, water in	19
B.		Climate, description of.....	11-13
Bailey, G. E., work of	7	Clothing, nature of	22-23
Banning-Dale route, description of	29	Cloudbursts, violence of.....	12
Barnwell route, description of	27	Coachella, Cal., wells at.....	79
Barrel Springs, Inyo Co., Cal., descrip-		Cold Spring, Cal., description of	31-32
tion of.....	31	Coleman-Mohave route, description of.....	33
Barrel Spring, San Bernardino Co., Cal.,		Coleman Springs, Cal., description of	36
description of.....	61-62	Colony well, Cal., description of	68
Barrel Springs, Nev., description of.....	87	Colorado desert, description of.....	11
Bedding, nature of	22	location of.....	5
Bedrock Spring, Cal., description of	52	Confidence Springs, Cal., description of....	39
Bennet's Wells, Cal., description of	38	Conglomerate, water in	19
Bird Spring, Cal., description of.....	33	Coolgardie, Cal., wells near	58, 59
Bitter Spring, Cal., description of.....	61	Copper Wells, Cal., description of.....	73
Blackhawk Well, Cal., description of	51	Corn Creek Springs, Nev., description of...	91
Black Mountains, Cal., wells on.....	38	Corn Springs, Cal., description of	81
Black's Well, Cal., description of.....	58	Coso, Cal., springs at	37
Blackwater Well, Cal., description of.....	52-53	Cottonwood Creek, description of.....	34-35
Bonanza Springs, Cal., description of	69	Cottonwood Springs, Riverside Co., Cal., de-	
Bonanza Well, Cal., description of.....	66	scription of.....	78
Bonnie Clair, Nev., wells at.....	88	Cottonwood Springs, San Bernardino Co.,	
Borax Well, Cal., description of.....	62-63	Cal., description of	56-57, 66
Borego Spring, Cal., description of.....	82	Cottonwood Springs, Nev., description of ..	93
Boulder Well, Cal., description of.....	73	Cove Springs, Cal., description of	66
Box S ranch, Cal., wells at.....	71-72	Cow Creek, description of	36
view at	66	Cow Spring, Cal., description of.....	38
Brier Spring, Nev., description of.....	88-89	Coyote Holes, Cal., springs at.....	49-50, 75
Brook Spring, Cal., description of.....	46	Coyote Well, Imperial Co., Cal., description	
Brown's Well, Cal., description of	79	of.....	86
Buckhorn Spring, Cal., description of	64	Coyote Well, San Bernardino Co., Cal., de-	
Bullfrog routes, description of	27-28	scription of	60-61
Bullion Mountains, Cal., spring on	74	view of	63
Burcham ranch, Cal., water at.....	71	Crater Spring, Cal., description of.....	56
Burro Spring, Cal., description of.....	32	Creosote bush, water near.....	21
		Cronese Spring, Cal., description of.....	61
C.		Crystal Spring, Cal., description of.....	37
Cactus Flat Springs, Cal., description of ...	72-73	Crystal Springs, Nev., description of	93
California, springs in, descriptions of	31-87	Culture, extent of	6-7
Camps, location of	16-17	Cunningham Spring, Cal., description of...	50
Cane Springs, Nev., description of	90	Currie Wells, Nev., description of	89
		Cushenbury Springs, Cal., description of...	72

D.	Page.		Page.
Daggett route, description of.....	27	Good Springs, Nev., description of.....	93
Dale-Amboy route, description of.....	28	Government Holes, Cal., description of....	63
Dale-Banning route, description of.....	29	Granite, water in.....	19
Dale-Mecca route, description of.....	28	Granite Mountain, Cal., springs on.....	68
Dale Pump, Cal., water at.....	76	Granite Tanks, Cal., description of.....	81
Danby, Cal., wells near.....	70	Granite Wells, Cal., description of.....	53
Dante Spring, Cal., description of.....	62	Grant Springs, Cal., description of.....	58
Data, accuracy of.....	7-8	Grapevine ranch, Cal., springs at.....	31
Daylight Spring, Cal., description of.....	34	Grapevine Springs, Inyo Co., Cal., descrip- tion of.....	31
Dead Man's Hole, Cal., description of.....	74	Grapevine Springs, Kern Co., Cal., descrip- tion of.....	42
Dead Man's Lake, Cal., well at.....	71	Gravel, water in.....	19
Death Valley, view in.....	10	Great Trough, location and character of... 10-11	
Death Valley region, description of.....	9-10	Greenwater, Cal., springs at.....	38
location of.....	5		
routes in, description of.....	26-27	H.	
Deep Springs, Cal., description of.....	31	Haggin Well, Cal., description of.....	50
Desert region, area and location of.....	5	Halloran Springs, Cal., description of.....	56
area and location of, map showing .. Pocket.		Hanna Well, Cal., description of.....	84
character of.....	8-9	Harper Lake, Cal., well at.....	65
industrial development in.....	6-7	Harper's Camps, Cal., wells at.....	54-55
mineral resources of.....	6	Harper Well, Cal., description of.....	85
watering places in.....	5-6	Hector, Cal., spring near.....	69
Desert Wells, Kern Co., Cal., description of.	57	Hidden Springs, Cal., description of.....	44
Desert well, San Bernardino Co., Cal., de- scription of.....	76	Hinkley Well, Cal., description of.....	65
Distances, pacing of.....	25	Hole in the Rock Spring, Cal., descrip- tion of.....	34
Dos Palmas, Cal., springs at.....	80-81	Hornet Springs, Nev., description of.....	91
Drinking, restriction on.....	23-24	Horsethief Spring, Cal., description of.....	50
Dry lakes, occurrence and character of....	17-18	Hot Springs, Cal., description of.....	39
wells at.....	18		
E.		I.	
Emigrant Springs, Cal., description of.....	35	Ibis, Cal., wells at.....	67
Epsom salts, occurrence of.....	15	Imperial Co., Cal., springs in.....	84-86
Esmeralda Co., Nev., springs in.....	87-88	Indian Spring, Esmeralda Co., Nev., descrip- tion of.....	87
F.		Indian Springs, Inyo Co., Cal., description of	32
Fairbanks ranch, Nev., description of.....	90	Indian Springs, Kern Co., Cal., descrip- tion of.....	64
Farmer, Nev., water at.....	88	Indian Springs, Lincoln Co., Nev., descrip- tion of.....	91
Faults, occurrence and character of.....	11	Indian Spring, San Bernardino Co., Cal., description of.....	59
Feed, provision for.....	21-22	Indian Well, Riverside Co., Cal., descrip- tion of.....	79
Fenner, Cal., wells at.....	66-67	Indio, Cal., wells at.....	79
Figtree John's Springs, Cal., description of.	83-84	Inyo Co., Cal., springs in.....	31-42
Fish Springs, Cal., description of.....	83	Iron Chief Well, Cal., description of.....	78
Flowing Wells, Cal., description of.....	65	Irrigation, development of.....	29
Food, nature of.....	23	Ivanpah route, description of.....	27-28
Fountain Springs, Cal., description of.....	35	Ivanpah Well, Cal., description of.....	57
Fourth of July Springs, Cal., description of.	44		
Francis Well, Cal., description of.....	57	J.	
Franklin Well, Cal., description of.....	36-37	Jacumba Springs, Cal., description of.....	87
Freeman, Cal., springs near.....	42	Johannesburg route, description of.....	26-27
Frémont, J. C., on Salt Spring.....	49	Johnnie, Nev., spring near.....	91
Frémont's trail, description of.....	25		
Frinks Springs, Cal., description of.....	84	K.	
Fuel, scarcity of.....	24	Kane Spring, Imperial Co., Cal., description of.....	85
G.		Kane Springs, Kern Co., Cal., description of.	50
Garlic Spring, Cal., description of.....	61	Kane's Spring, San Bernardino Co., Cal., description of.....	69
Garlock, spring near.....	50	Kane's Wells, Cal., description of.....	59
Getting lost, precautions concerning.....	24-25	view of.....	60
Glaubers salt, occurrence of.....	15	Keane Spring, Cal., description of.....	34
Goffs, Cal., well at.....	67		
Goldbelt Spring, Cal., description of.....	33		
Goldfield route, description of.....	28		
Gold Mountain, Nev., well at.....	87		
Goleta Spring, Cal., description of.....	57-58		

	Page.		N.	Page.
Keeler-Mohave route, description of	26	Needles, Cal., wells at.....	67-68	
Kern Co., Cal., springs in.....	42, 57	Needles-Parker route, description of	28	
Kessler Springs, Cal., description of.....	56	Nevada, springs in.....	87-93	
Kevidrup Spring, Nev., description of.....	90	Newberry Springs, Cal., description of.....	65	
Kingston Springs, Cal., description of.....	49	New England Springs, Nev., description of.....	93	
Klinefelter, Cal., springs at.....	67	New River, description of.....	15	
Klinker Mountain, wells on	51	Nye Co., Nev., springs in	88-92	
Kramer, Cal., wells near.....	65			
L.		O.		
Lander Well, Cal., description of.....	42	Oasis, Cal., springs at.....	31	
Langford Well, Cal., description of.....	61	Oasis Valley, Cal., springs in.....	89	
Las Vegas route, description of.....	28	Old Camp, Nev., spring at.....	87	
Leach's Spring, Cal., description of	44-45	Old Spanish trail, description of.....	26	
Lead Spring, Cal., description of.....	54	Old Woman Mountain, Cal., spring on.....	74	
Le Conte Springs, Cal., description of.....	68-69	Old Woman's Springs, Cal., description of..	70, 73	
Lightfoot Well, Cal., description of.....	78	Ord Spring, Cal., description of.....	68	
Limestone, water in	19	Out West Well, Cal., description of.....	63-64	
Lincoln Co., Nev., springs in.....	92-93	view of	10	
Lone Willow Spring, Cal., description of...	44	Owens River, description of.....	14	
Lost. <i>See</i> Getting lost.		Owl Springs, Cal., description of.....	45-46	
Lost Horse Spring, Cal., description of.....	77			
Lucerne Valley, well in.....	72	P.		
M.		Pachanca Springs, Cal., description of.....	50	
McCain Springs, Cal., description of	84-85	Packard Well, Cal., description of	79	
McCoy Spring, Cal., description of.....	82	Pahrump, Nev., springs near.....	91	
McDonald Spring, Nev., description of.....	89	Palmdale, Cal., springs at.....	77	
Magnesia Spring, Cal., description of	77	Palmetto, Nev., water at	87	
Manse Springs, Nev., description of.....	91-92	Palm Springs, Riverside Co., Cal., wells at.	77	
Map of desert region	Pocket.	Palm Springs, San Diego Co., Cal., descrip-		
accuracy of.....	7	tion of.....	85	
Marl Spring, Cal., description of	63	Palm Well, Cal., description of.....	78	
Mascot Spring, Cal., description of.....	69	Palo Verde Mountains, Cal., description of.	82, 84	
Mason ranch, Cal., springs at	85	Paradise Springs, Cal., description of.....	59-60	
Mean's Well, Cal., description of.....	73	Parker-Needles route, description of.....	28	
Mecca, Cal., springs at	80	Peacock Springs, Cal., description of.....	69	
Mecca-Dale route, description of.....	28	Pilot Springs, Cal., description of	53-54	
Mellen, wells at	70-71	Pinkham, C. A., work of	8	
Mesquite, water near.....	20	Piñon Pine Well, Cal., description of.....	78	
Mesquite Spring, Inyo Co., Cal., description		Piute Springs, Cal., description of.....	64	
of.....	32	Piute Springs, Nev., description of.....	93	
Mesquite Spring, San Bernardino, Cal.,		Poison Spring, Cal., description of.....	34	
description of	75	Poison springs, nonoccurrence of	15, 48-49	
Mesquite Springs, Nev., description of.....	92	Precipitation, records of.....	12-13	
Mesquite Well, Cal., description of	85	Providence Wells, Cal., description of.....	66	
Mesquite Wells, Nev., description of.....	93	view of	66	
Mexican Camp Spring, Nev., description of	89	Provisions, nature of	23	
Mill Camp, Cal., springs at.....	81	Purslane, water near.....	20	
Miller's Well, Cal., description of.....	76			
Miller Wells, Nev., description of.....	90-91	Q.		
Mineral resources, development of.....	6	Quail Springs, Cal., description of.....	43, 45, 75	
Mohave-Coleman route, description of.....	36			
Mohave Desert, location of.....	5	R.		
Mohave-Keeler route, description of.....	26	Rabbit Springs, Cal., description of	71	
Mohave River, description of	10, 14	Railroad Tank, Nev., description of.....	90	
Mono County, Cal., springs in.....	31	Railroads, construction of.....	6-7	
Mountain Palm Springs, Cal., description		Rainfall, records of.....	12-13	
of.....	85	Rest Spring, Cal., description of.....	32	
Mountains, springs and tanks in	17	Resting Springs, Cal., description of....	39-40, 41	
Mountain Springs, Cal., description of.....	86-87	Ricardo, springs near.....	50	
Mountain Spring, Nev., description of.....	92	Riggs Well, Cal., description of.....	55-56	
Mud Springs, Nev., description of.....	89	Ring Well, Cal., description of	33	
Mule Springs, Cal., description of.....	84	Rivers, description of	13-15	
Murphy's Well, Cal., description of.....	58	Riverside Co., Cal., springs in.....	77-84	
		Rock Corral, Cal., spring at	73	
		Rocks, water in	18-20	

	Page.		T.	Page.
Rock Springs, Cal., description of.....	64	Tanks, location of.....		17
Rodriguez, Cal., wells at.....	64	Teams, choice and care of.....		21
Rodriguez Lake, Cal., spring at.....	64-65	Tecopa Well, Cal., description of.....		41-42
Rose Springs, Cal., description of.....	37	Temperature, records of.....		12
Rose's Well, Nev., description of.....	90	Thorp Mill, Nev., description of.....		88
Ruiz Well, Cal., description of.....	33	Tiefort Mountain, Cal., well at.....		54
S.		Toltec, Cal., wells at.....		56
Saccatone Springs, Cal., description of.....	57	Tomaso Springs, Cal., description of.....		55
Saline Valley Well, Cal., description of.....	33	Tonopah Well, Nev., description of.....		88
Salt Creek Wells, Cal., description of.....	34	Tools, need for.....		22
Salt grass, water near.....	21	Topopah Spring, Nev., description of.....		90
Salton Sink, location and character of.....	10	Toro Springs, Cal., description of.....		79-80
Salt Spring, Cal., description of.....	48-49	Traveling, hints on.....		21-25
water from, poison in.....	48-49	routes for.....		25-29
Salt Well, Inyo Co., Cal., description of.....	35	Triangle Spring, Cal., description of.....		33
Salt Well, San Bernardino Co., Cal., de- scription of.....	43	Tule Springs, Cal., description of.....	32, 38,	41
San Bernardino Co., Cal., springs in.....	43-77	Tule Springs, Nev., description of.....		92
San Bernardino Mountains, spring on.....	72	Tules, water near.....		20
Sand, water in.....	18-19	Tunnels, drainage, uselessness of.....		18
San Diego Co., springs in.....	84, 85-87	Turtle Mountains, Cal., description of.....		77
Sand Springs, Cal., description of.....	31	Twenty-nine Palms Spring, Cal., descrip- tion of.....		76
Sandstone, water in.....	19	V.		
Sandy, Nev., springs near.....	93	Vallecito Springs, Cal., description of.....		84
Saratoga Springs, Cal., description of.....	47	Valley Spring, Cal., description of.....		46
roads to.....	48	water from, analysis of.....		46
Schist, water in.....	19-20	Valley Wells, Cal., description of.....		56
Searchlight route, description of.....	28	Vegas Springs, Nev., description of.....		92
Searles, Cal., springs near.....	42-43	Vegetation, character of.....	20, 21	
Searles Lake, Cal., springs near.....	43	water near.....	20-21	
Searles Springs, Cal., description of.....	42	Victorville, Cal., well at.....		68
Seattle Well, Nev., description of.....	88	Victorville routes, description of.....	28-29	
Seventeen Palms Springs, Cal., description of.....	82-83	Vontreger Springs, Cal., description of.....		64
Shale, water in.....	19	W.		
Shaves Well, Cal., description of.....	80	Warren's ranch, Cal., springs at.....		75
Siam, Cal., wells near.....	69-70	Warren's Well, Cal., description of.....		75
Silver Lake, Cal., wells at.....	55	Washington Tank, Cal., description of.....		78
Sinks, occurrence and character of.....	17-18	Water, boiling of.....		23
wells at.....	18	discovery of.....	16-21	
Skilling Wells, Cal., description of.....	51	source of.....	13	
Slate Range, Cal., springs in.....	43	<i>See also</i> Rivers; Springs; Wells.		
Soda Lake, location and character of.....	10, 15	Water Station, Cal., wells at.....		57
spring and wells at and near.....	62, 63	Wells, concealment of.....		16
Soda Springs, Cal., description of.....	83	West Wells, Cal., description of.....	74-75	
Spanish trail, old; description of.....	26	Wheeler Spring, Cal., description of.....		54
Springs, descriptions of.....	31-93	Whitney Spring, Cal., description of.....		54
descriptions of, symbols used in.....	30-31	Wilbur Well, Cal., description of.....		73
location of, map showing.....	Pocket.	Wild Rose Spring, Cal., description of.....	37-38	
occurrence and character of.....	15-16, 17	Willard Lake, Cal., well at.....		52
Squaw Spring, Cal., description of.....	51	Williams Well, Cal., description of.....		55
Staininger's ranch, springs at.....	31	Willow Spring, Esmeralda Co., Nev., de- scription of.....		88
Star Springs, Cal., description of.....	58	Willow Springs, Inyo Co., Cal., description of.....	32, 37	
Stirrup Tanks, Cal., description of.....	78	Willow Springs, Kern Co., Cal., description of.....	51	
Stovepipe Wells, Cal., description of.....	34	Willow Spring, Nye Co., Nev., description of.....	88	
Stubby Springs, Cal., description of.....	77	Willow Springs, San Bernardino Co., Cal., description of.....	60, 65-66, 69	
Stump Spring, Nev., description of.....	92	Wilson's Spring, Nev., description of.....		93
Sulphur Springs, Cal., description of.....	75-76	Y.		
Summit Diggings, Cal., springs at.....	51	Yuba Springs, Cal., description of.....		86
Sunflower Spring, Cal., description of.....	70			
Sunset Springs, Cal., description of.....	86			
Surprise Spring, Cal., description of.....	73-74			
Surveyor's Well, Cal., description of.....	33			
Sweetwater Springs, Cal., description of...	49			
Symbols, use of, for springs shown on map.	30-31			



GENERAL MAP
SHOWING APPROXIMATE LOCATION OF
BETTER KNOWN SPRINGS AND WELLS
IN THE
MOHAVE AND ADJACENT DESERTS
SOUTHEASTERN CALIFORNIA AND
SOUTHWESTERN NEVADA

0 10 20 30 40 50 miles
1908

LEGEND

- Spring
- Well
- Pumping plant
- Flowing well

Topography compiled from
U. S. Geological Survey atlas sheets,
Terrell's map of Southern California,
and other sources



Sheet numbers from
U. S. G. S. atlas sheets



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